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Apr.
1960

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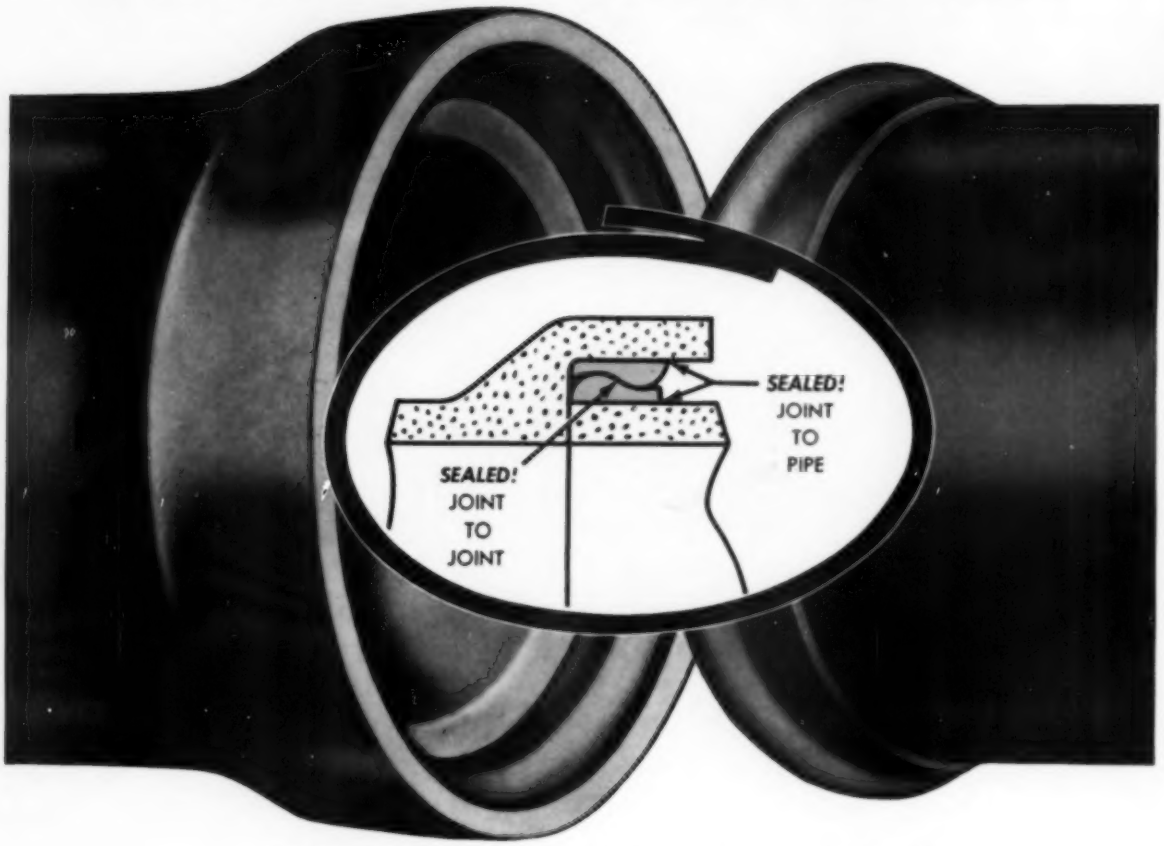
C. F. Wertz is Director of the Department of Water and Sewers for Miami and adjacent Florida communities. He will become President of the AWWA at the annual meeting next month. More data on page 18.

Wedge-Lock®

HANDLES INFILTRATION!



ROOT-TIGHT SEAL!

Patented Wedge-Lock Joints are bonded to Vitrified Clay Pipe—*at the factory*—to bring you the highest performance standards . . . the lowest installation costs.

One simple, easy operation and the joint's tightly sealed around the full pipe circumference . . . stays in continuous compression for the life of the pipe.

MINIMUM INFILTRATION!

When you specify Wedge-Lock, you reduce infiltration and resist root problems before they start . . . keep installation costs down . . . benefit from the guaranteed performance of the world's longest-lasting pipe.

Write to listed manufacturers for literature or an actual Wedge-Lock demonstration

Wedge-Lock CLAY PIPE

THE FACTORY-JOINTED CLAY PIPE AVAILABLE NATIONALLY FROM LOCAL MANUFACTURERS

Order Wedge-Lock from any of these Vitrified Clay Pipe Manufacturers:

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The Clay City Pipe Company....Uhrichsville, Ohio
The Evans Pipe Company.....Uhrichsville, Ohio
Graff-Kittanning Clay Products..Worthington, Pa.
Larson Clay Pipe Company.....Detroit, Mich.
The Logan Clay Products Company..Logan, Ohio
The Robinson Clay Product Co......Akron, Ohio
The Stillwater Clay Products Co...Cleveland, Ohio
Superior Clay Corporation.....Uhrichsville, Ohio

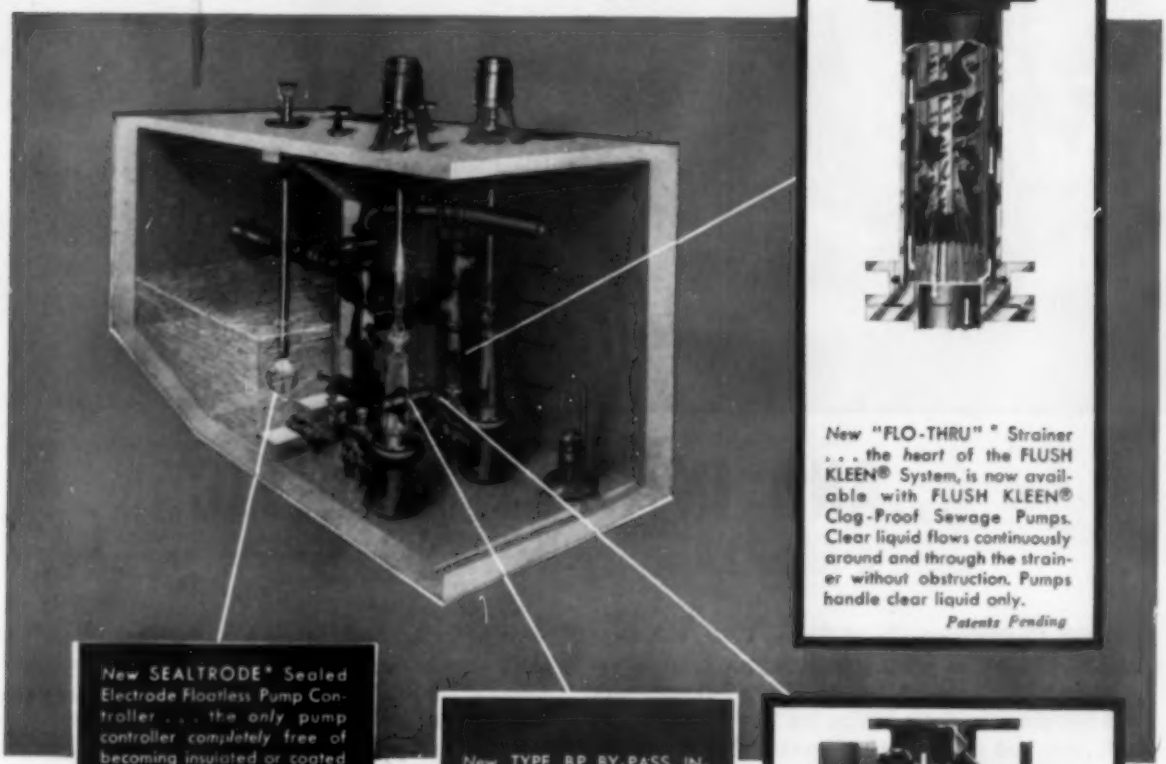
WLC-159-166-A

"from Chicago" the NEW FLUSH KLEEN® story

A development of 50 years of research, engineering, product improvement . . . and customer service.

better than ever FLUSH KLEEN® clog-proof sewage pumping

- Lower original cost . . . smaller pumps and motors required
- By-pass fittings allow pumps to be selected on hydraulic basis only . . . without reference to inflow
- By-pass fittings allow greater inflow capacity
- Pumps handle clear liquid only
- Absolutely reliable pumping performance
- Less maintenance
- 100% standby capacity
- Longer pump life



High Wet Strength Paper Products And Other Solids are never a problem with the new "FLO-THRU"* Strainer.

New "FLO-THRU"* Strainer . . . the *heart* of the FLUSH KLEEN® System, is now available with FLUSH KLEEN® Clog-Proof Sewage Pumps. Clear liquid flows continuously around and through the strainer without obstruction. Pumps handle clear liquid only.

Patents Pending

New SEALTRODE* Sealed Electrode Floatless Pump Controller . . . the *only* pump controller *completely* free of becoming insulated or coated with grease or corrosive elements found in sewage and drainage water.

New TYPE BP BY-PASS INFLOW FITTINGS . . . permitting strained sewage to flow directly to the Wet Well, completely by-passing the pumps.

NEW Non-Slamming BY-PASS Valve . . . red area denotes valve open . . . allowing by-passing to occur.

*Trademark

OVER 13,000 FLUSH KLEEN® INSTALLATIONS

See your nearby "Chicago" Distributor today . . . or write direct for full details.

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FOOD MACHINERY AND CHEMICAL CORPORATION
HYDRODYNAMICS DIVISION

CHICAGO PUMP

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1960 — 51 YEARS — CHICAGO PUMP COMPANY — 1909

SIDE DUMP BUCKET PRODUCES 30% MORE

...AND IN HEAVY TRAFFIC

Leftwich Construction Co. of Provo, Utah, is helping install five miles of sewer line through a busy section of Idaho Falls, Idaho. A No. 955 Series E Traxcavator with side dump bucket is loading trucks with blasted lava rock, clay and river gravel. Despite heavy traffic and tough material, the job is on time.

Owner Jack Leftwich estimates production is more than 30% greater with his new No. 955 Traxcavator than with his former machine. "The dealer demonstrated the No. 955 for two days," he reports, "and its speed and side dump bucket sold us. There's not another machine that can beat it for production. The versatility and performance of our No. 955 make the profit on a closely bid job."

The speed of the No. 955 is due to many things. The fast hydraulic system, for instance, cuts cycle time and increases maneuverability in close quarters. And operator visibility is excellent. The seat is high and the compartment uncluttered. Tractor controls are located for convenient handling—bucket controls at the right arm rests are closely spaced for easy one-hand operation.

There's speed, too, in maintenance of the Series E. With hydraulic track adjusters an ordinary grease gun is all that is necessary to put proper tension on tracks. Lifetime lubricated rollers require no lubrication service until rebuilding. The exclusive Caterpillar oil clutch provides up to 2,000 operating hours without adjustment.

Here's a machine built to last. Box construction track roller frame absorbs the loads and stresses of tough jobs. Lift arms are made to stand up under heaviest digging and lifting.

Your Caterpillar Dealer would like to give you a demonstration of the speed, versatility and maneuverability of the No. 955 with side dump bucket. Call him. The tougher the job, the better.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

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BOOST PRODUCTION AND LOWER COSTS WITH A VERSATILE TRAXCAVATOR

PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATE

APRIL, 1960 • Volume 91, Number 4

Storm Water Pumping for an Urban Expressway 77
Automatically controlled pump station with three 6500 gpm pumps provides drainage for an open cut section. FRANK J. BUCKLEY

Tapping the Potomac 79
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Complete mixing activated sludge plant provides treatment for wastes from a small industry. ROSS E. MCKINNEY AND DONALD SCHWINN

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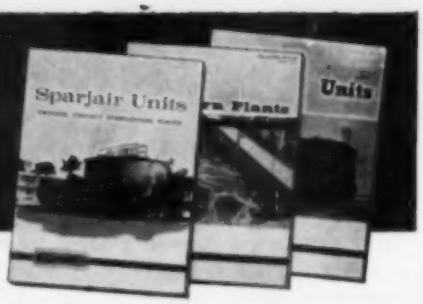
WALKER PROCESS PACKAGE PLANTS

UNIT DESIGNS FOR SMALL SEWAGE TREATMENT PLANTS

SIMPLE OPERATION — 90% automatic
ODOR FREE — no septic or stale operations
ADAPTABLE — concrete or steel tank construction



Details and preliminary plans are available to Consulting Engineers and their Architects, concerned with the design of small communities, subdivisions, institutions, schools, etc.

SPARJAIR Unit installed at a large Florida motel to handle 25,000 gpd combined sanitary and restaurant wastes. Note proximity of plant to motor court. Odor-free operation eliminates need of isolating plant.

SPARJAIR UNIT — Nested Contact Stabilization Plant — an easy to operate, low cost, small sewage treatment plant that is a model of simplicity. Designed on a new but proven principle, the contact stabilization process aerates and thoroughly oxidizes all odors in the sewage and overcomes previous objections to locating a plant near residences, shopping areas, schools, etc. Raw sewage settling tanks and septic digesters are eliminated. This plant utilizes a separate chamber for complete aerobic digestion (42% volatile remaining) of excess sludge.

Simple operation with minimum moving parts requires only part time attention. Capacities from 50 to 5000 population equivalent.

AEROBURN PLANTS — Package Aerobic Digestion; 24-hr. "Wet Burn" Aeration—designed for installations where economy is a prime factor and clarity of plant effluent is not vital. As with SPARJAIR units, the operation is odor free and practically automatic; with no delicate biological balances to achieve and hold.

Four standard sizes at 50, 100, 150 and 200 population equivalent.

SPARJPAC — Package Trickling Filter Plants — combines trickling filter and "wet burning" digestion in a two-story, compact design to provide best features of each type of treatment. SPARJPAC plants utilize DOWPAC® trickling filter media, developed by The Dow Chemical Company.

Design capacities range from 50 to 2500 population equivalent.

(DOWPAC is a registered trademark of The Dow Chemical Company).

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ZF PREFABRICATED PUMPING STATIONS

THIS IS THE STATION THAT IS PREFABRICATED AND DELIVERED TO JOB SITE

READY TO OPERATE

A PACKAGED UNIT—completely shop-fitted with quality components throughout. Transported to job site ready for installation.

SIMPLIFIES LOCATION—underground operation permits use of existing public property such as parkways, etc. Saves cost of surface property and enclosing structure.

ECONOMICAL—saves costs and time. Prefabrication results in lower construction costs and less time at job site. Simply set in place, connect and start up.

COMPLETE DATA, SPECIFICATIONS AND DRAWINGS AVAILABLE—WRITE

ZF ZIMMER & FRANCESCON P.O. BOX 359, MOLINE, ILLINOIS

THE EDITOR'S POINT OF VIEW

Every Community Needs a Complete Job of Waste Treatment

PRIMARY TREATMENT of sewage or industrial waste will remove objectionable floating material and thereby improve the appearance of a stream. But it does not do a good job of reducing the organic load on the stream. Thus a primary plant nibbles at, but does not solve, the problem of controlling stream pollution and of making sorely needed water usable.

Consulting engineers, city engineers and state sanitary engineers can and should do more hard selling on the need for a complete job of waste treatment. If a complete plant is installed initially, the cost will be greater than for primary treatment alone, but less than the total cost of a primary plant now plus a secondary plant in a few years.

Most communities have a sense of pride and a willingness to do a good job. Engineers should not be afraid to recommend and urge what is best for the entire area, including that downstream from the treatment plant.

Proper Utilization of Consulting Skills Benefits Everyone

THERE HAS been a lot of loose talk about the use of consulting engineers in the Interstate Highway System. Some folks, apparently without knowledge of engineering realism, seem to feel that employment of consultants for such work is practically immoral.

We believe that a good engineering organization is an essential for every state, city and county. We also believe that consulting engineers should be employed when a job requiring special knowledge or skill must be done or when a volume of engineering work is required beyond the work capacity of the existing city, county or state staff. We do not think it is economical to maintain a public engineering organization large enough to meet all potential needs; nor do we think such organizations should hire specialists for a specific job and then either discharge them after the job is completed, or utilize a small part of their skills in routine work.

The fees consulting engineers get are not large; as a result they normally do the work at a no higher cost. Their use allows the work to be speeded up. They supplement and strengthen existing civil service staffs. Each group of engineers has its place in which it performs best and most economically and a judicious use of each results in the greatest good to the taxpayer.

Conference Associations Bring Continuing Benefits

WHEN THE roll is called at a conference or convention of public works officials, it is always disappointing to note several members absent "due to travel restrictions." While all public bodies and their responsible officials must be cognizant of expenditures, no greater return can be gained for so modest an investment than that made in active participation in the committees and associations dedicated to the continued improvement of technology, procedure and standards in the public works field.

The invigorating experiences shared, the problems compared and the bonds of friendship established, send participants home with a renewed enthusiasm for the job ahead. No problem is so unique nor solution so specialized that its sharing can't benefit both the giver and the receiver. By active support of our associations we are meeting one of our responsibilities as good citizens of our profession.

More Engineers for Water and Sewerage Departments

MANY WATER and sewerage departments which do not have a full-time sanitary engineer could greatly profit from such a service. However, not ever having had an engineer, it will often be the case that there is no precedent and no guide for what he might do. Unfortunately, many young engineers lack the necessary imagination and controlled aggressiveness to develop for themselves a satisfactory field of work. Here is a chance for state sanitary engineering staffs. But the first step is not to persuade the community to hire an engineer. Initially, the important thing is to study the operation to determine where and how an engineer can best be employed, and then to write a job description to cover his work. If this is done, the engineer comes into the department with a chance to do useful work and not as a potential handy man to do those minor things no one else wants to do.

PIPE THAT DOESN'T GET COLD FEET IN WET TRENCHES

This cast iron pipe was installed to carry water to an important industrial site in Indiana.

At the time of installation, weather conditions were severe; the trenches were wet and muddy.

Still, the cast iron pipe was easily and speedily assembled, enabling the contractor to complete the job well ahead of the deadline.

Cast iron pipe does not get cold feet over rugged soil conditions. Its rugged design, corrosion-resistant qualities, and bottle-tight joints will withstand the most severe pressures.

Modern, cement-lined cast iron pipe will deliver a continued full flow of water for at least a century . . . and rarely requires repairs or replacement.

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Thos. F. Wolfe, Managing Director,
3440 Prudential Plaza, Chicago 1, Illinois

CAST IRON PIPE
THE MARK OF THE 100-YEAR PIPE

The CLEVELAND JS-30

WITH INSTANT LATERAL

DIGGING WHEEL POWER-SHIFTS 5 FEET FROM SIDE TO SIDE

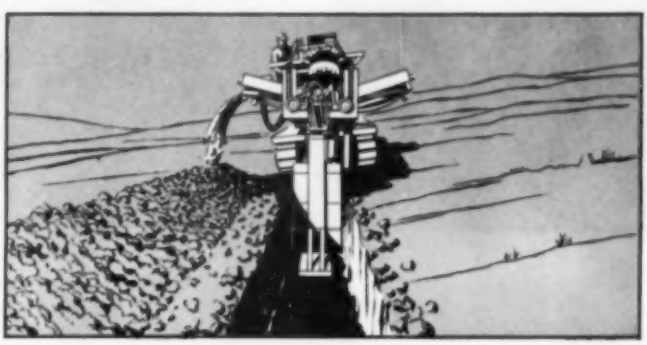
Digs trench behind either crawler or anywhere within its 6-foot width

Lateral shifting of the JS-30's wheel, up to 2½ feet to either side of center, is done hydraulically under lever control at operator's location, so trench can be dug at any point within 6-foot-wide path made by the crawler. Edge of 24-inch trench can be dug 5 inches outside either track, permitting trench to be flush with parallel pavement, curbs, sidewalks, etc. With wheel tilted, trench can be dug virtually flush with trees, poles, fences and other above-ground obstructions.

INSTANT DIGGING WHEEL TILT

cuts blocking, cribbing costs

Hydraulic power-tilting of the JS-30's digging wheel to either side of vertical – a total tilting range of 14° – under lever control at the operator location, permits digging vertical trench on side slopes and in similar conditions with one crawler track on a higher level than the other. This eliminates the necessity of blocking, cribbing, etc. in such conditions. Power-tilt adds 7 inches to the outside cut of the digging wheel. This in combination with lateral power-shift permits digging trench virtually flush with above-ground obstructions.

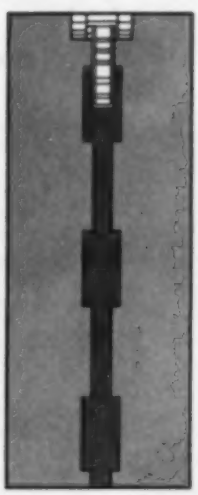


—a trencher of amazing utility

DIGGING WHEEL POSITIONING

EXCAVATES BELLHOLES saves on trench width

Power-shifting and power-tilting of the JS-30's digging wheel are especially valuable in cutting trench to extra width required at pipe joints. This permits digging trench to narrow width except where bellholes are required. By utilizing power-shift the JS-30 can dig up to 6 ft. wide, down to 5½ ft. deep — reduces slower hoe-work to clean-up, etc.



PLUS THESE OUTSTANDING CLEVELAND FEATURES

- Every operation is automatic, completely controlled at operator seat.
- Hydraulic crumbing shoe raised and lowered under lever control from operator seat.
- Automatic conveyor shifting for side-to-side positioning.
- V conveyor for faster, higher, more efficient spoil discharge.
- Pulley-enclosed, dual conveyor drives, with instant belt speed and direction control.
- 33 positive non-slipping digging speed-and-power combinations.
- World's finest trencher crawlers, 1000-hour-lubricated.

DIGGING CAPACITY: 5 ranges, from 11" to 24" wide, to 5½' deep; to 6' wide with power-shift.

POWER: 370 cu. in. diesel—59 HP @ 1250 RPM.

WIDTH: 6' over crawlers; 7' 11" over conveyor.

HEIGHT: 8' 2" digging; 9' 5" reading.

LENGTH: 27' 3".

Pioneer of the Modern Trencher ®

The CLEVELAND TRENCHER Co.

20100 St. Clair Avenue • Cleveland 17, Ohio

How Lincoln, Ill., sewage plant

SOLVED HEAVY GREASE LOAD PROBLEM

with one Dorrco Vacuator®

A large institution's decision to grind all its garbage threw a monkey wrench into Lincoln's plans for improving its sewage treatment plant. The institution was already a heavy grease contributor. Increased strength of the sewage would be tremendous. Calculations showed that Lincoln must be prepared to handle wastes equal to those of a town double its size!

Could the town alter its plans, handle the heavier loads and do it efficiently and economically?

It did – with the help of Dorr-Oliver equipment. In one major move a 26' dia. Dorrco Vacuator was installed for primary treatment and the original settling tanks became intermediate tanks. In the first year of operation, BOD removal through the Vacuator ranged from 19 to 27% – averaging 22%. Suspended solids removal averaged 34%. Not only that, the Dorrco Vacuator proved it could reduce digester requirements by pumping thick sludge averaging 3.6% in solids content to the digester. In short, the Dorrco Vacuator was a vital factor in solving Lincoln's problems – for years to come.

Complete information on the Dorrco Vacuator is readily available. Ask for Bulletin No. 6301. Or write Dorr-Oliver Inc., Stamford, Connecticut, for details on the complete line of sewage treatment equipment.

Plant Superintendent: Lawrence Arthur
Consulting Engineers: Crawford, Murphy & Tilly, Springfield, Illinois

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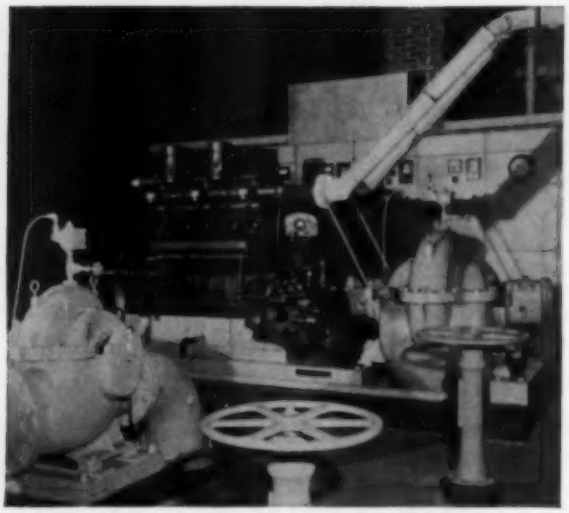
Company

We look forward to welcoming you at our first Convention appearance since the Hersey Manufacturing Company and the Sparling Meter Company joined together "under one banner".

At the Hersey-Sparling booth we can give you full details on the world's most complete line of water measuring and control equipment for Municipal, Industrial and Irrigation Service. We will be glad to see you.

Hersey-Sparling Meter Company; Hersey Products: Dedham, Mass.; Sparling Products: El Monte, California; Branch offices in all principal cities.

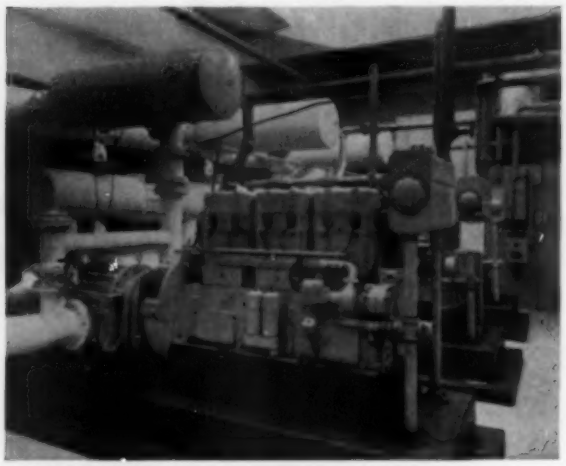
Booth Numbers 97—100



EAST—North Stamford, Connecticut—water pumping system.

All over the country, municipal and utility plants use ROILINE engines in water supply systems, waste disposal services, and for power generation. Operating on natural or LP gas, or gasoline, ROILINES have been standard in the field for many years.

ROILINE ENGINES



MID-CONTINENT—Waste disposal power in Enid, Oklahoma.

WEST—Rivera, California—deep well pumping power.

NATURAL GAS RATINGS					600	800	1000	1200	1400	1600	1800	2000	2200	2400
MODEL	Bore & S.	Cyls.	Displ.	Torque–rpm	BRAKE HORSEPOWER AT ENGINE SPEEDS INDICATED									
H570	4⅜ x 4¼	8	570	457-1400	...	68	86	104	122	139	156	172	188	198
H844	5¼ x 4⅞	8	844	644-1200	...	96	121	147	172	196	219	237	248	256
F1500	6¾ x 7	6	1503	1090- 600	125	165	200	215						
H2000	6¾ x 7	8	2004	1490- 650	170	225	270	290						
L3000	6¾ x 7	12	3006	2200- 700	250	335	405	435						
L3460	7¼ x 7	12	3468	2500- 900	285	380	474	555	592 @ 1350					
L4000	7.54 x 7.5	12	4000	3020- 600	345	447	550	635						

With oil pump, water pump, magneto, air cleaner, carburetor, and exhaust muffler. Hp shown is maximum.

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CALIFORNIA, Long Beach, Engine & Equipment Company
COLORADO, Denver, Emrick & Hill Engine & Equipt. Co.
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LOUISIANA, New Orleans, Southern Engine & Pump Co.
MICHIGAN, Reed City, Hafer Engine Company
NEW YORK, Syracuse 6, J. C. Georg Corporation
OHIO, Columbus 19, Cantwell Machinery Company
OKLAHOMA, Oklahoma City 9, Carson Machine & Supply Co.
PENNSYLVANIA, Bradford, R. R. Reck Company
TEXAS, Houston 1, Southern Engine & Pump Co. (also in Beaumont, Corpus Christi, Dallas, Edinburg, Kilgore, San Antonio)
Lubbock, Farmers Supply
Odessa, General Machine & Supply, Inc.
Wichita Falls, Nortex Engine & Equipment Co.
WYOMING, Casper, Emrick & Hill Engine & Equipt. Co.

471

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Factories: Waukesha, Wisconsin and Clinton, Iowa

BEST DUMP HEIGHT IN ITS CLASS

Loads trucks up to a foot higher than ordinary tractor shovels

In its class, only an Allis-Chalmers 72-hp HD-6G can lift and dump your loads above the 9-ft level! And you get a bonus in reach, too. This 1½-yd unit easily dumps over the center of sideboarded 12-yd trucks . . . puts loads just where you want them on stockpiles or when loading out over excavations.

We'd like to demonstrate on your job in your trucks.

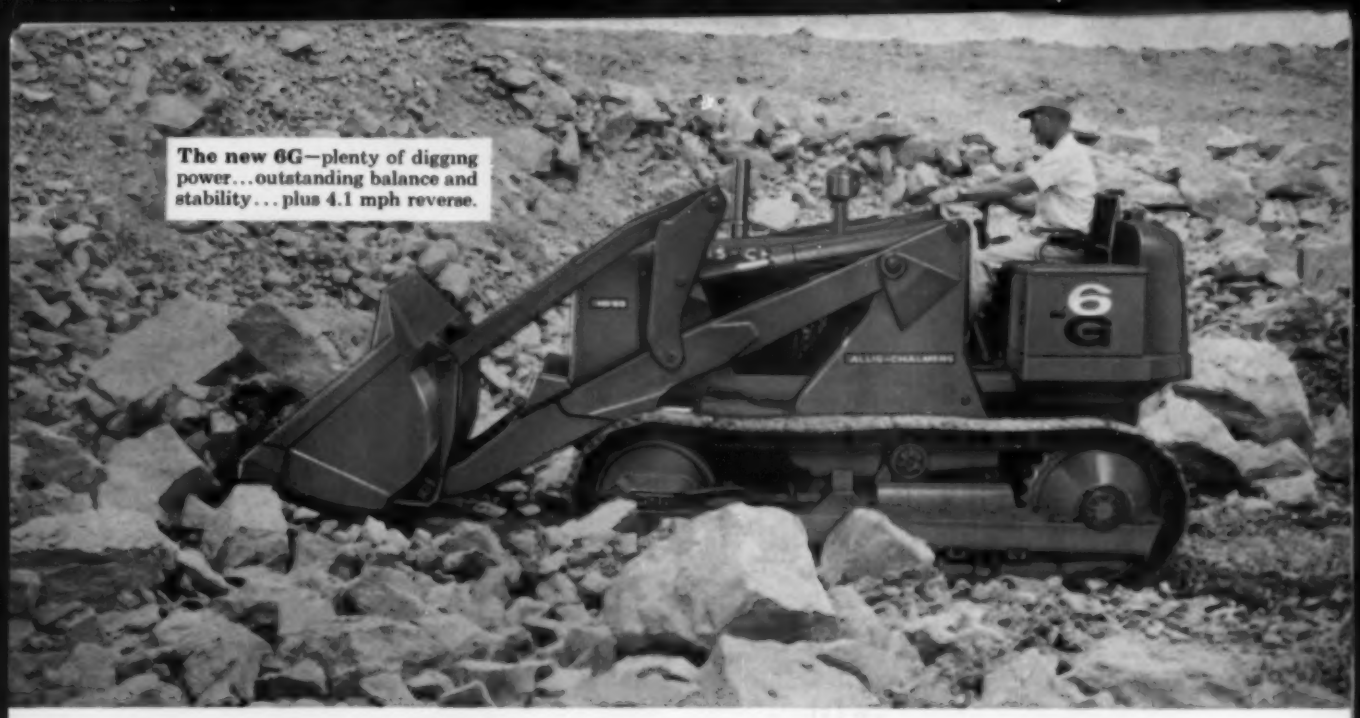
ALLIS-CHALMERS

HD 6G

move ahead with

ALLIS-CHALMERS

...power for a growing world



Your Allis-Chalmers dealer will show you the

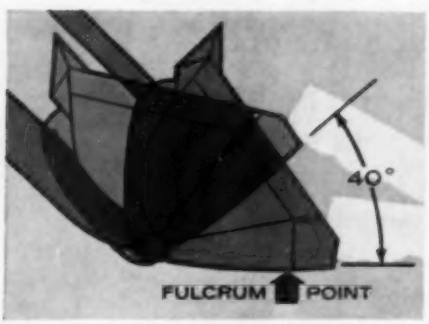
6G's BIG DIFFERENCE

9 ft dump height, long reach, plus many other exclusive advantages make it the finest 1½-yd Tractor-Shovel you can buy.

Shown here are only a few of the important differences found on the 72-hp HD-6G.

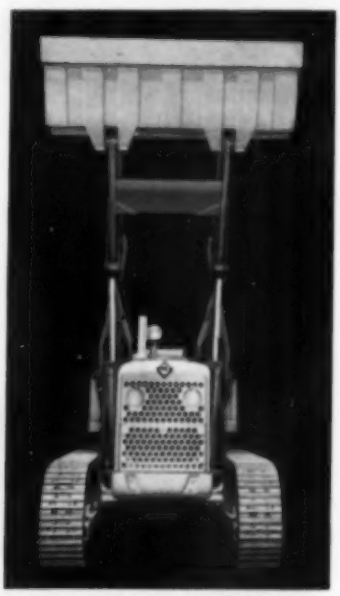
In addition, the 6G is alone in its class with the kind of big-tractor main frame that absorbs shock, adds to dependable, long-life operations. The 6G offers you true unit construction, too . . . allowing quick replacement of clutches, transmission or engine without disturbing adjacent assemblies.

Be sure the "big difference" is on your side—your Allis-Chalmers dealer can give you the details. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.



37% more pry-out than any in its class. Exclusive rolling leverage develops over 10½-tons of breakout because the fulcrum point is close in behind the cutting edge.

Permanently lubricated truck wheels, idlers and support rollers—exclusive PERMA-SAFE design with Positive Seals and power-saving tapered roller bearings.



"In-line" booms and linkage. New straight-line design adds solid-steel strength from ground level to more than 9-ft dump height.

move ahead with ALLIS-CHALMERS

...power for a growing world

"LET ME SHOW YOU THE DIFFERENCE IN A TRULY WHITE, LEAD-FREE REFLECTIVE BEAD"

There is a marked difference in reflective bead quality, determined largely by degree of whiteness and lead-free quality. On these two important factors depends the brilliance, reflectivity and ultimate performance of the product. To meet Flex-O-Lite's rigid quality standards, only the *whitest white, lead-free* beads can pass inspection. Add to this, technological advances, long experience and manufacturing know-how and you have the reasons why highway signs and markers, reflectorized with Flex-O-Lite beads, literally leap out of the darkness to contribute greater safety for the motoring public . . . greater satisfaction and economy for you. Write for new brochure today.

FLEX-O-LITE PRODUCTS

1. No. 831 LEAD-FREE High Index of Refraction Beads and Sign Kits. Best for white and yellow signs.

2. US 68 LEAD-FREE Medium Index of Refraction Beads and Sign Kits. For application to signs in the darker pigment colors—greens, reds, blues, etc.

3. TYPE H SAFETY SPHERES—For danger points such as guard rails, curbs, bridge abutments, medians, hydrants and other hazardous areas where ultra-high brilliance is required. Many times brighter than paint or ordinary reflectorization.

4. TRAFFIC BEADS—Free Flowing, Moisture-Proof and Standard Beads. Tops in eye-catching brilliance and dependable reflectorization on highway center lines and edge line markings.

5. ALL-WEATHER AIRPORT RUNWAY BEADS—500 to 1,000% brighter than standard beads at angles of descent ranging from 10 to 30%.

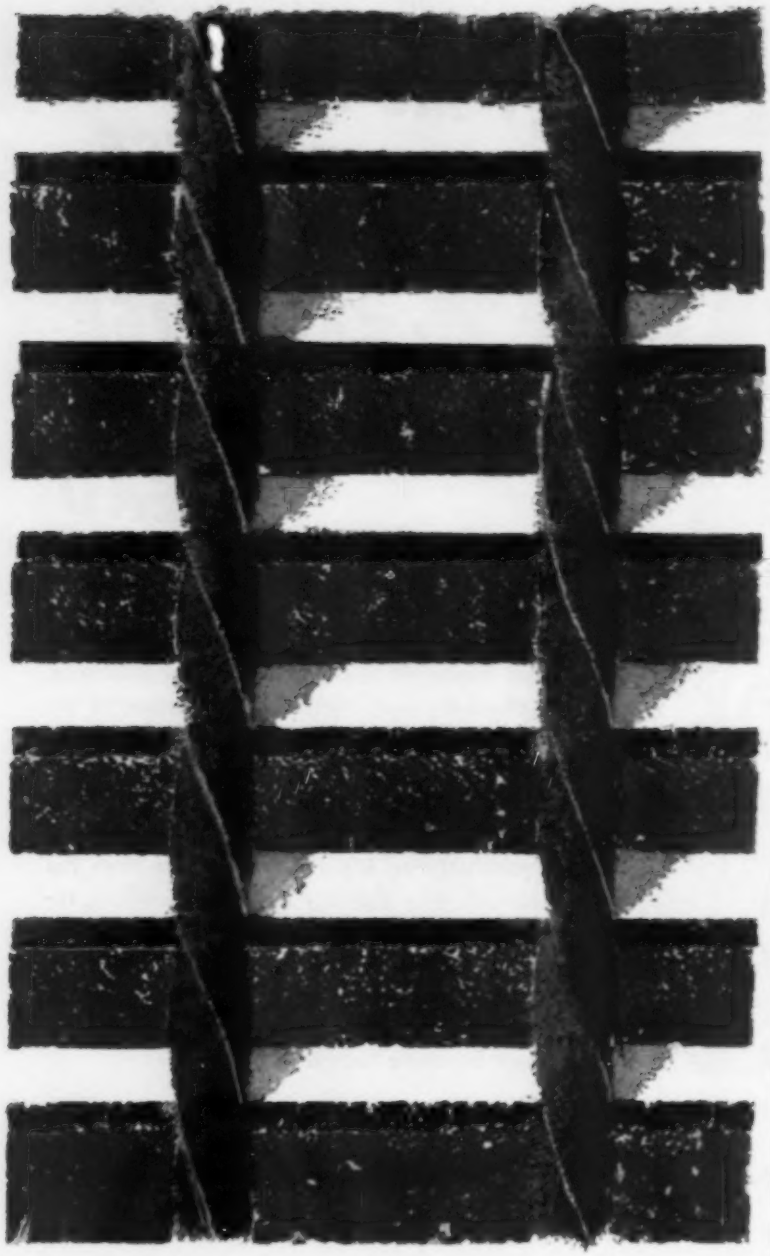
6. FLEX-O-LITE ALSO MAKES: New Positive Free-Flowing Traffic and Sign Bead Dispensers. The economical answer to the problem of reflective glass bead application. Details on request.

FLEX-O-LITE

FLEX-O-LITE MANUFACTURING CORP.

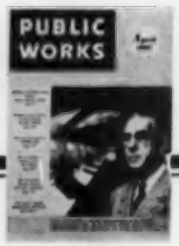
8301 Flex-O-Lite Drive, St. Louis 23, Missouri • Factories in St. Louis; Paris, Texas; St. Thomas, Ontario, Canada

MAKERS OF DROP-ON, FREE-FLOWING, STANDARD, MILITARY, MOISTURE-PROOF, HIGH INDEX AND SIGN BEADS



Blaw-Knox Electroforged Grating solves so many problems for so many industries. Catalog free on request. Write Blaw-Knox Equipment Division, Pittsburgh 38, Pennsylvania.

BLAW-KNOX
GRATING



Claude F. Wertz has been Director since 1955 of the Department of Water and Sewers, City of Miami, Florida, which serves a total population of approximately 550,000 in Miami and fourteen other cities, towns and portions of unincorporated Dade County. For fourteen years previously he was Resident Engineer, representing the consulting engineering firm of Day & Zimmerman, Inc., of Philadelphia.

Born in Reading, Pa., he was graduated with a BS in sanitary engineering from Pennsylvania State. Following six years with the Pennsylvania Department of Health, he was with Fuller and McClintock and Gascoigne & Associates, later Havens & Emerson. In 1933 and 1934 he was technical adviser for the Nichols Engineering and Research Corporation and was Resident Engineer on the construction at Dearborn, Michigan, of the first plant-size sewage sludge incinerator in the United States. He is a registered Professional Engineer in Pennsylvania and Florida.

A member of AWWA since 1924, and now Vice President, he will be elected president at the May convention. He has been active in AWWA affairs and has received many awards and honors, including the George Warren Fuller Award for outstanding service in the field of public water supply.

He is a fellow in the ASCE, a diplomate of the American Academy of Sanitary Engineers, and a member of the Water Pollution Control Association, the Florida and Pennsylvania Sections of this Association, and the Florida and Pennsylvania Water Works Operators Associations.

Mr. Wertz is married. His hobbies, for which he says he finds little time at present, are gardening and golf.

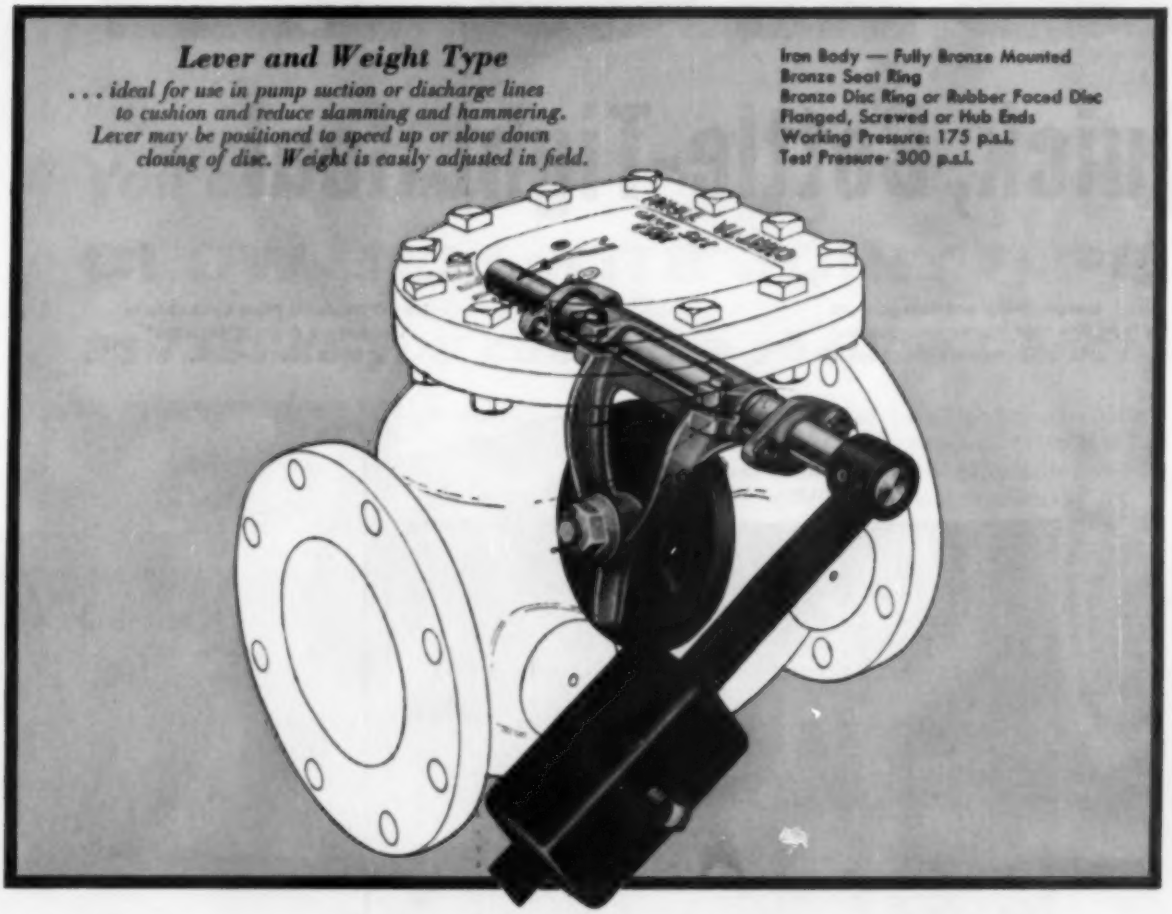
MUELLER® Check Valves

heavy duty disc assembly that lasts and lasts!

Lever and Weight Type

. . . ideal for use in pump suction or discharge lines to cushion and reduce slamming and hammering. Lever may be positioned to speed up or slow down closing of disc. Weight is easily adjusted in field.

Iron Body — Fully Bronze Mounted
Bronze Seat Ring
Bronze Disc Ring or Rubber Faced Disc
Flanged, Screwed or Hub Ends
Working Pressure: 175 p.s.i.
Test Pressure: 300 p.s.i.



All working parts of these new Mueller Swing Type Check Valves are heavily made to assure long service life and dependable operation *without maintenance.*

A heavy stainless steel hinge pin is used on all lever and weight type (shown) and lever and spring type check valves. This pin is extended through the hinge plugs to permit the lever to be used on either side of the body. An "O" ring on the plug prevents leakage around the pin.

The plain type, without lever, weight or spring, uses a new combined hinge pin and plug which is securely and accurately held to the body by studs and nuts. An "O" ring positively seals the plug to prevent leakage.

Large, wear-resistant bearings and a full-width clapper arm hinge, used in all types, accurately and rigidly align the disc to eliminate chatter and vibration.

These new, heavy duty check valves have been specifically designed for repeated opening and closing applications in water works pumping stations, water filtration plants, sewage treatment plants and general industrial plants. They are suitable for horizontal or vertical installation on water or oil lines.

Write for specifications.

The many exclusive features of these new check valves are typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product.

MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

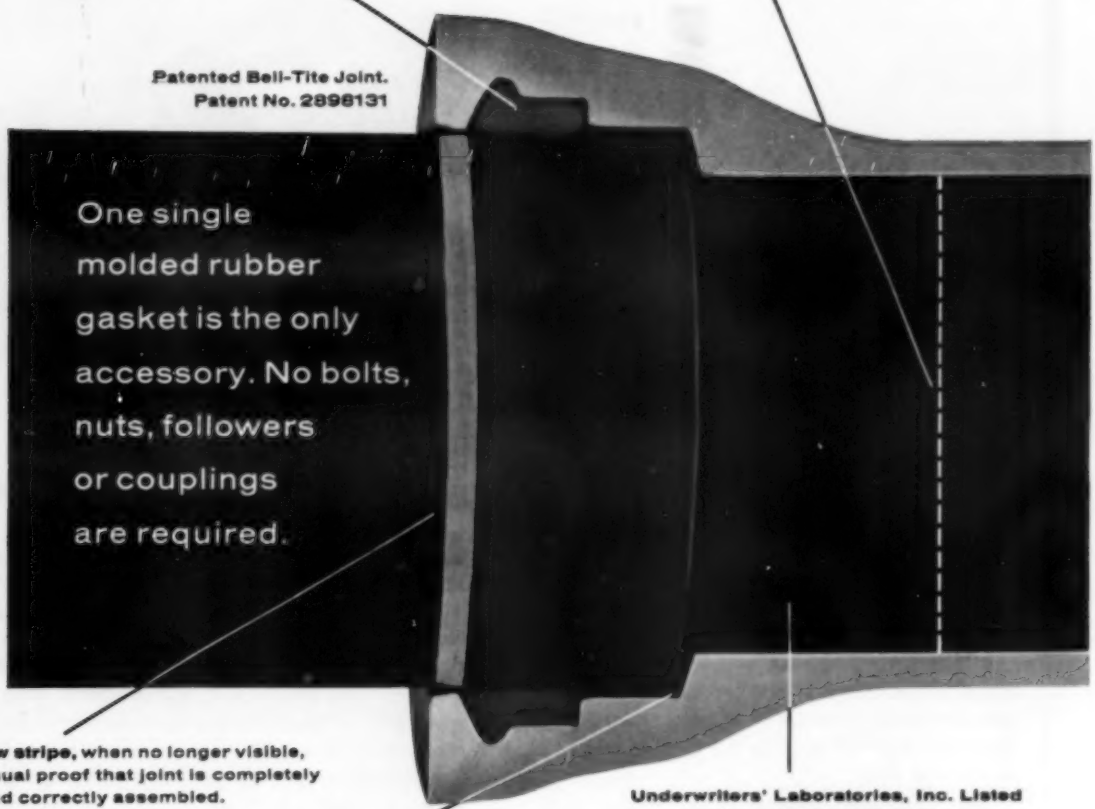
CLOW

Quick, Bottle-Tight Seal

Large, thick section gasket of long-life high durometer rubber forms pressure-tight seal.

Bell-Tite Joint Pipe available in diameters from 3" thru 24" in 18 foot lengths.

Patented Bell-Tite Joint.
Patent No. 2896131



This yellow stripe, when no longer visible, provides visual proof that joint is completely and correctly assembled.

Underwriters' Laboratories, Inc. Listed for working pressures up to 350 psi.

Ample deflection to meet casual curves or grades is provided by space in socket of the bell.

CLOW CAST IRON PIPE

Cast Iron Pipe Plants at
BENSENVILLE, ILLINOIS • BIRMINGHAM, ALABAMA • COSHOCTON, OHIO

CAST IRON PIPE

You can install

CLOW BELL-TITE® JOINT PIPE

as fast as you can dig a shallow trench

Pictures show CLOW 20" Bell-Tite Joint Cast Iron Pipe being installed to provide water for a mid western industrial development. CLOW Bell-Tite Joint Cast Iron Pipe was selected because of its proved long life and the ease and speed of installation. Hulett Corporation, contractors.

LOWER
pipe into trench

SWING
into open bell

SEAL for
pressure-tight
joint

JAMES B. CLOW & SONS, INC.
201-299 North Talman Avenue, Chicago 80, Illinois

Subsidiaries:
Eddy Valve Company
Waterford, N.Y.

Iowa Valve Company
Oskaloosa, Iowa

Springfield, Illinois, sewage plant. In foreground, three Verti-Flo Clarifier Basins. *Inset:* Partitioning baffles divide tank into efficient vertical-flow cells. V-notched weirs control cell-to-cell flow, minimize short-circuiting. Each basin equipped with two longitudinal and one cross collector.

C. C. Larson, district manager, Springfield Sanitary District; A. Paul Troemper, district engineer; Jenkins, Merchant & Hankivil, consulting engineers.

REX® Verti-Flo® Clarifiers boost capacity, reduce space

Thousands of dollars in valuable plant space were saved when consulting engineers and the management of the Springfield, Illinois, Sanitary District selected Rex Verti-Flo Clarifiers for their recent plant expansion. In addition, their selection provides for economical plant growth in the future.

Rex Verti-Flo's unique design gives Springfield over twice the capacity of conventional clarifiers—in the SAME amount of space.

An exclusive operating principle provides this increased capacity: a system of multiple cells changes the flow from horizontal to vertical. The main body of each Verti-Flo tank is proportioned into four cells with a generous weir length around each.

Another important reason why Verti-Flo operates efficiently at higher overflow rates is this: it allows a tank to be hydraulically balanced after construction.

Easily Adapted to Existing Tanks

Existing tanks can be readily converted to the Rex Verti-Flo design. Better results are assured and increased capacity is guaranteed. Both cost and alterations to existing structures are minimized.

Send for Full Information

To obtain maximum capacity in any old or new plant, find out about Rex Verti-Flo Clarifiers. Write CHAIN Belt Company, 4722 W. Greenfield Avenue, Milwaukee 1, Wisconsin.

REX®
CHAIN BELT COMPANY

Dumping through the bottom of the bucket clears sticky materials, increases dumping height to 9 ft, 6 in.

Dozer moldboard is tilted forward or backward to increase or decrease depth of cut for precision grading accuracy.

In scraper position the 4-in-1 loads from the bottom with the fast, live "boiling action" of earthmoving scrapers.

With the 4-in-1 clamshell you have exclusive ability to "surround" loose materials instead of chasing them.

Now! Profit-earning Four-in-One in a ¾-yard economy size

For thousands of dollars less than ever before you now can profit from the unlimited job range of an International Drott 4-in-1! The low-cost but rugged International Drott T-340 4-in-1 opens vast profit opportunities new to the 45 hp* loader class. At the touch of a hydraulic control lever the 4-in-1 does the work of a carry-type *scraper*, a *bulldozer*, a *clamshell*, as well as of a conventional *loader*... Yet, your investment is only a little more than for a single-purpose ¾-yard loader! With the T-340 4-in-1 you can handle dozens of specialized jobs you can't touch with a limited-duty rig. Operating costs are *low* because of the T-340's rugged dependability and proven fuel economy. Output is *high*, because of the T-340's proven ability to deliver greater push and pull-power—to move bigger loads faster and at lower cost—than any other tractor in its size class!

An earthmoving fleet at your fingertips!

Prove the exclusive profit-boosting advantages of an International Drott T-340 4-in-1 for yourself. Your IH dealer will gladly demonstrate! For his name and specification folder, write International Harvester Company, Dept. PW-4, P. O. Box 7333, Chicago 1, Ill.

**Maximum engine horsepower at standard conditions.*

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL® DROTT®

ANNOUNCING THE NEW

up to 30 mpg!

Totally new for *total* savings! Ford's new Falcon Ranchero delivers up to 30 miles on a gallon, yet its new 90-hp Six is geared to do a real job! There are lower costs for oil, tires, brakes, parts . . . nearly everything!

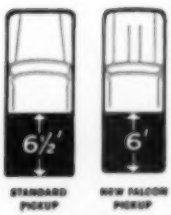
lowest priced* pickup!

The Falcon Ranchero is priced from $89 to $210 under competitive ½-ton pickups!* And that's just the start of your savings. Single-Unit construction saves on maintenance . . . it's tighter, quieter, with main underbody members zinc-coated against rust and corrosion. See your Ford dealer!

*Based on latest available manufacturers' suggested retail delivered prices with comparable standard equipment.

FORD Falcon RANCHERO

big 6-foot box!



Load capacity is more than ample for most pickup hauls—nearly 7½ feet of load length with tailgate flat. And thanks to the low loading height, loading and unloading is faster, easier!

- Up to 30 miles on a single gallon of gas
- Up to 4000 miles between oil changes
- Diamond Lustre finish needs no waxing
- Low loading height
- Instant-lock tailgate opens, closes with a single, one-hand motion
- Roomy comfort for three passengers
- Styled to capture admiration

FORD TRUCKS COST LESS

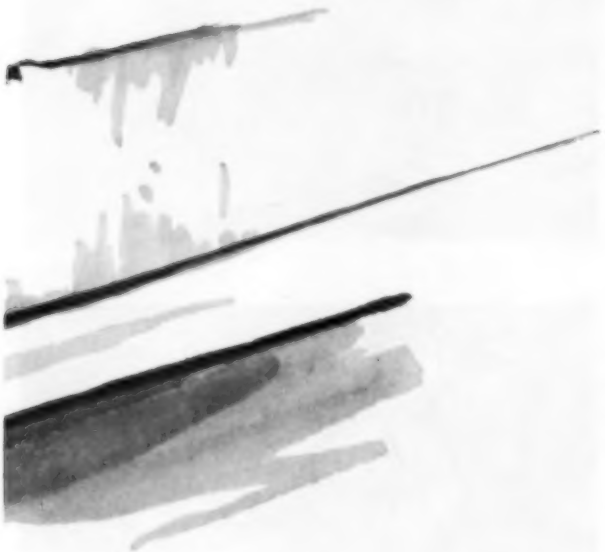
LESS TO BUY... LESS TO RUN... BUILT TO LAST LONGER, TOO!

"They wuz a little slow beginnin'... but look at 'em lay Tyton now!"

U.S. cast iron PIPE FOR WATER, SEWERAGE AND

everybody's doin' it

Laying Tyton Joint® pipe, that is. This easy-to-assemble pipe is so foolproof even a bear can get in the act. Only one accessory needed—a simple rubber gasket. No bell holes. No caulking equipment. No nuts or bolts to fiddle with. No weather worries, either. Tyton doesn't mind wet feet . . . can be laid in rain or wet trench. Result: more working days, more lengths laid per man hour, lower installation cost. Sound interesting? It is! Call or write for the facts.



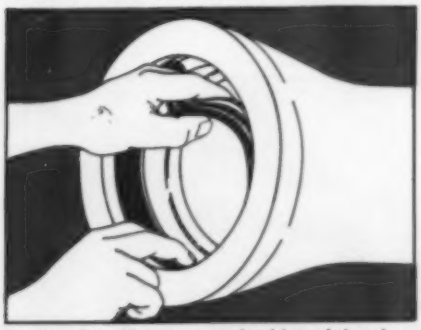
U.S. PIPE AND FOUNDRY COMPANY
General Office: Birmingham 2, Alabama

A Wholly Integrated Producer from Mines and Blast Furnaces to Finished Pipe.

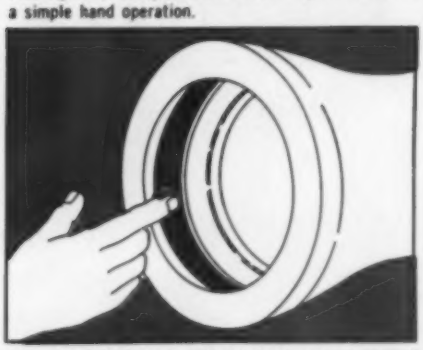
INDUSTRIAL SERVICE CAST IRON

TYTON®

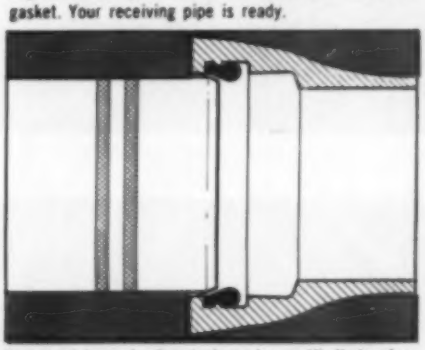
ONLY FOUR SIMPLE ACTIONS



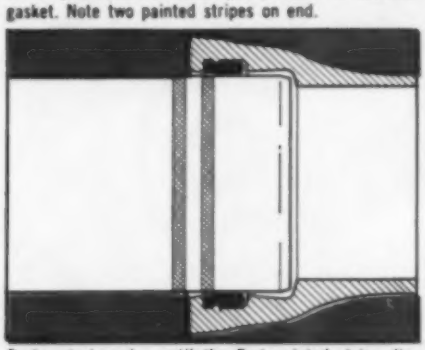
Insert gasket with groove over bead in gasket seat . . . a simple hand operation.



Wipe film of Tyton Joint® lubricant over inside of gasket. Your receiving pipe is ready.



Insert plain end of entering pipe until it touches gasket. Note two painted stripes on end.



Push entering pipe until the first painted stripe disappears and the second stripe is approximately flush with bell face. The joint is sealed . . . bottle-tight, permanently! The job's done . . . . fast, efficiently, economically. Could anything be simpler?

What other culvert material has all the

LONG SERVICE LIFE. Drainage pipe made of Beth-Cu-Loy steel sheets often outlives the original need. It can then be lifted out and placed in a new location for additional years of service. The copper content of the steel base, along with a heavy zinc coating, give Beth-Cu-Loy sheets a very high resistance to corrosion.

MEETS AASHO SPECS. Beth-Cu-Loy culvert sheets conform in every way to AASHO standards. Bethlehem furnishes a sheet manufacturer's certified analysis and guarantee, which includes the average chemical composition by ladle analysis.

EASY TO INSTALL. Light enough to be laid without special equipment. Long pipe lengths reduce the number of field joints, speed up laying.

FIELD JOINTS IN MINUTES. No sealing compound needed, no mortar to set. Just a connecting band of Beth-Cu-Loy secured around the joint with a few turns of a wrench on the bolts . . . it's no more complicated than that.

Steel

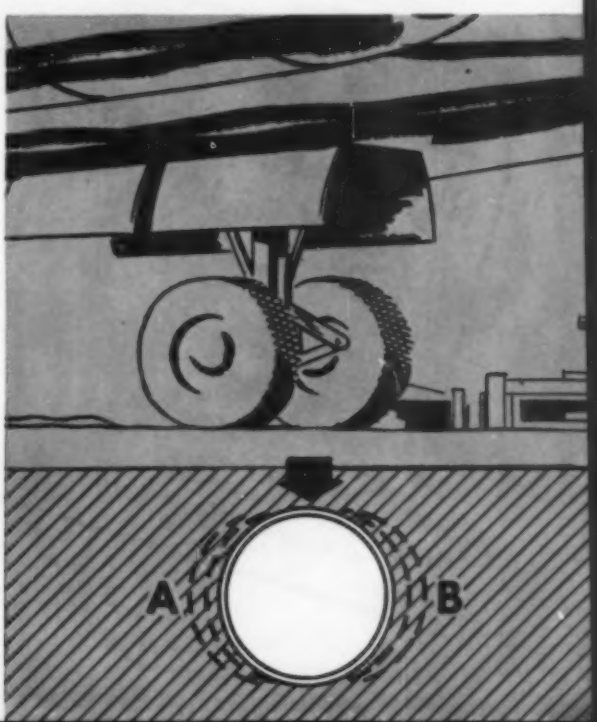
For strength
. . . economy
. . . eye-appeal

advantages of corrugated Beth-Cu-Loy sheets?

SIMPLIFIES GRADE AND ALIGNMENT. Because it is made of steel, a Beth-Cu-Loy drainage structure is highly resistant to fracture, needs no feather bed. Flexible enough to conform to slight changes in grade and alignment.

LESS COSTLY TO SHIP. Corrugated steel drainage pipe weighs a lot less per running foot, thus lowers shipping charges. Here, more than a quarter of a mile of Beth-Cu-Loy is handled on one truck trailer.

FLEXES WITH FILL. Pipe made of corrugated Beth-Cu-Loy steel is flexible transversely as well as longitudinally, thus can enlist the aid of surrounding material to support imposed loads. The drawing shows how a vertical load produces pressure against fill at points A and B, setting up counter-loads which largely offset the forces through the vertical axis.



BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

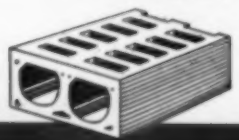
BETHLEHEM STEEL

30 years from now...

Photo courtesy of Johnson Motor.

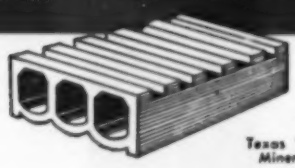
NEW HANDBOOKS NOW READY

Mr. City Engineer and Mr. Consultant . . .
If you haven't already received your free copy of the new data-filled Handbook of Trickling Filter Design, which contains latest ASTM Specifications for vitrified clay underdrain blocks, write for a copy now.
Send your request to the nearest member firm listed at right.



BOSCO
Bowerston Shale Co.
Bowerston, Ohio

TFFI Trickling



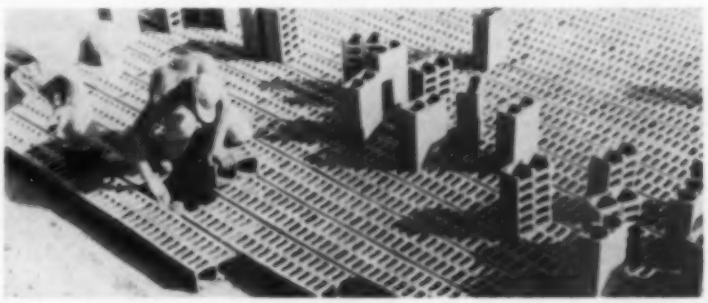
TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas

HOW WELL WILL YOUR TREATMENT PLANT STILL BE SERVING?

Unpolluted water in ample supply is a priceless asset to any community, industrially and for recreation. To end stream pollution, more and more trickling filters are being built . . . more than any other type.

A big reason for preferring them is that on the basis of past performance many trickling filters will still be operating as well 30 years later as when first installed. No other type is easier to add to if growth exceeds original estimates.

TFFI Vitrified Clay Trickling Filter floor underdrains are best



Installing TFFI vitrified clay floor bocks at Somerset, Penn.

The most vital part of trickling filters is the underdrain system. Failures here spell real trouble later. But when the floor is of TFFI Specification vitrified clay blocks this is guarded against. It is inherent in clay to resist successfully the ravages of acids, alkalis and bacteriological action. TFFI clay blocks are made in modern plants under rigid controls of quality that no substitute material can even approach. (Only with them do you get a 50-year Guarantee.)

DICKEY
W. S. Dickey Clay Mfg. Co.
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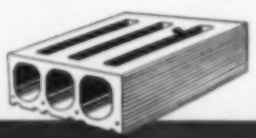
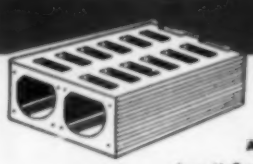
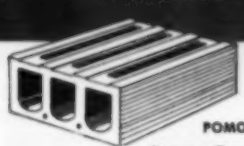


NATCO
Pittsburgh 22, Pa.
327 Fifth Ave.
Natco Corporation

Filter Floor Institute



AEMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.



POMONA
Pomona Terra-Cotta Co.
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TRANSLOT
Connelton Sewer Pipe Co.
Connelton, Ind.

Equipment and Materials for your PUBLIC WORKS PROGRAM

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

NEW LISTINGS

Hard to Select A Standby Electric Plant?

519. With this brochure it becomes easy. A "must" for those who need emergency power, it discusses every usual question that must precede selection, gives suggestions for planning and designing of the standby installation. Write D. W. Onan and Sons, Inc., 2515 University Ave., S.E., Minneapolis 14, Minn., or use the reply card.

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545. Gathered in one booklet is practically the whole story on warning devices and how to use them. Catalog 55 is veritable gold mine of such information. Covers lanterns, flashers, torches, safety suggestions. For your copy write R. E. Dietz Co., 225 Wilkinson St., Syracuse, N. Y., or circle card-number.

New Grader Bulletin Available . . .

547. . . . describes the construction of graders and their features, including the new constant mesh transmission. In addition there is a new 4-page two-color Specification Sheet, which also features the optional equipment available on Huber-Warco motor graders. Get yours by writing Huber-Warco Co., North Greenwood St., Marion, Ohio, or circle the number on card.

To Insert Valves Under Pressure . . .

555. . . . let your first step be review of this "step-by-step" folder on Mueller tapping and cutting-in sleeves and valves. Write Mueller Co., Decatur, Ill., for Form W-8899 or circle number on our card.

Pipe that Baffles the Most Determined Roots

556. Orangeburg root-proof pipe and fittings for house sewer lines and other outdoor underground non-pressure applications. Also Orangeburg Perforated Pipe for subsurface drainage, septic tank fields, etc. Catalog 307 is yours for the asking and tells all about them. Address Orangeburg Mfg. Co., Div. The Flintkote Co., 375 Park Ave., New York 22, N. Y., or circle the card-number.

To Dig or Lift with High Efficiency and Low Cost

569. Find out what a Bantam truck-crane can do to help you. Three bulletins describe many models, up to 11-ton lifting capacity. A "natural" for Public Works operations. For bulletins address Schield Bantam Co., Waverly, Iowa, or circle card-number.

Need Engineering Data on Diatomite Vacuum Filter Plants?

578. There is a comprehensive technical bulletin that will prove helpful to designers and operators of swimming pools and municipal or industrial water plants. To get yours address B-I-F Industries, Inc., 345 Harris Avenue, Providence 1, R. I., or circle our card-number.

Concrete Pressure Pipe . . .

591. . . . and all of its advantages when made by Price Brothers Co. are described, illustrated and its manufacture explained in an attractive 24-page booklet that pipe buyers and layers will appreciate. Just address Price Brothers Co., 1932 E. Monument Ave., Dayton 1, Ohio, or circle the card-number.

For Rain, Turn the Valve.

580. Make your own "rainy season" when and where you want it with a Nelson-Rain Bird System. No more dry lawns or roadsides when you have it. Many unique features that will make their brochure interesting—and valuable—to you. Just address Rainy Sprinkler Sales Div., 609 West Lake St., Peoria, Ill., or circle the number on card.

"The Importance of Timely Spring Maintenance" . . .

584. . . . is the ideal title for an ideally-timed folder on procedures for spring conditioning of unpaved roads. The part that calcium chloride can play in loose gravel roads is covered with brief clear text and appropriate charts. Just write for yours to Calcium Chloride Institute, 909 Ring Bldg., Washington 6, D. C., or circle the number on card.

Don't Fool Around with Weeds —Eliminate Them

599. With Amizol and Amizol combinations, advantages are better kills, lower costs, longer spraying seasons. For full-color brochure that tells the whole story of better weed and vegetation killing, address AMCHEM Products, Inc., Ambler, Pa., or circle card-number.

MORE LISTINGS ON PAGES 34 TO 51

Save Money While Pumping Sewage or Storm Water

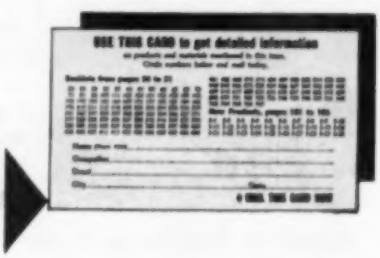
616. New line of prefabricated pumping stations hold down on-the-job costs and give new economies. Ideal for municipalities, housing projects, sanitary districts, resorts, shopping centers, etc. Address Zimmer & Francescon, 1715 15th Street Place, Moline, Ill., or circle card-number.

Engines for Your Natural Gas

649. Complete line for all applications. Booklet 20173 shows model views, specifications, and fuel consumption curves as well as performance facts. Get yours from Industrial Engine Plant, Caterpillar Tractor Co., Peoria, Ill., or check code number on card.

To Heat and Re-Mix Stockpiled Asphalt

654. . . . the Wylie HEAT-A-MIX Tailgate Asphalt Mixer can ease your labors. New 4-page fully illustrated brochure describes how it works and why you need it. Address Wylie Mfg. Co., Box 7086, Oklahoma City 12, Okla., or circle above number on card.



Elgin. "We selected International because we needed heavy-duty engines that would keep working under extremely dusty conditions," reports Chief Engineer Robert Schmidt, Elgin Sweeper Co.

Galion. "We chose International for fast parts and service coverage, and operating economy," says Chief Engineer James Roberts, Galion Iron Works & Manufacturing Co.

Austin-Western. "On-the-job reports prove that IH power is an excellent choice for our crane," H. P. Lockhart, Assistant General Manager, Sales, Austin-Western, Construction Equipment Division, Baldwin-Lima-Hamilton Corp.

ENGINEERS SAY IT...

public officials agree

"International engines provide excellent power for heavy-duty municipal equipment"

More and more, public works officials specify IH power, to make sure they get expertly engineered and perfectly matched equipment for all municipal needs. And specifying an International engine usually agrees with the manufacturer's preference for IH power. Equipment builders prefer International engines for many of their products, because this automatically gives them the dependable, economical, trouble-free performance their customers demand. And you, as the customer, get these built-in benefits every time you specify International power.

The broad line of low-cost IH power extends this efficient performance to every municipal application. When you approve International engines for generators, pumps, construction and maintenance machinery, or auxiliary units, you get more years of dependable power for fewer tax dollars. A wide variety of accessory equipment lets you further match the power to the job.

There are 32 engines in the International line—16.8 to 385 max. hp—gasoline, LP gas, natural gas or diesel. See your IH Engine Dealer or Distributor soon. Discover what International power can do for you!

INTERNATIONAL® ENGINES

International Harvester Co.,
180 North Michigan Ave., Chicago 1, Illinois
A COMPLETE POWER PACKAGE

To order these helpful booklets check the reply card opposite this page.

NEW LISTINGS (Cont.)

The Perforated Pipe You Have Been Waiting For

619. The new asbestos-cement pipe for subsurface drainage of streets, highways, airports, flood control projects, plant sites. Has great crushing strength with outstandingly good weight-strength ratio. Write for literature on Transite Underdrain Pipe to Johns-Manville, 22 East 40th St., New York 16, N. Y., or circle the number on card.

"Rip the Daylights out of Masonry Sawings Costs"

635. What to do it with is fully described in new literature "New from Truco" on drilling machines, bits and accessories; also concrete, masonry and stone saws and diamond blades. Address Truco Masonry Drilling Division, Wheel Trueing Co., 3200 West Davison, Detroit 38, Mich., or circle number on our card.

Make Your Concrete Sewers Still Better . . .

653. . . . by using TYLOX gaskets in the joints. Rubber and neoprene, available for all pipe sizes, afford quickly-made, watertight, flexible, durable and chemically-resistant joints. New 20-page brochure "Tylox Rubber Gaskets" covers all these advantages in detail. Address Hamilton Kent Mfg. Co., Kent, Ohio, or circle the card-number above.

Need a Flow Meter? Here's a New One . . .

642. . . . to meet need for a low-cost yet accurate and dependable instrument for measuring open-channel sewage flows. Compact, portable, mechanically operated, needs no external power. Interchangeable cams and scales for various flumes and weirs. Many other features. Get Bulletins 24 and 28 from Leupold & Stevens Instruments, Inc., 4445 N. E. Glisan St., Portland 13, Oregon, or check reply card.

TENNANT MODEL 100 is available with cab, power steering, flashing lights, rotating beacon, etc.

Now . . . a new way to sweep up ALL the dirt

You've never seen such clean sweeping as you'll get with the TENNANT Model 100 Vacuumized Sweeper.

Powerful pickup. Cleaning a 7'4" path, this remarkable new sweeper gets virtually *all* the dirt. Particles fine as 5 microns (far smaller than human eye can see) are caught by the huge 540 sq. ft. filter.

No dust, no water. Since the Model 100's powerful brush-and-vacuum system captures the dust, there's no need for water spray . . . therefore no unsightly mud streaks, no winter freeze-up problem.

Many uses. Short (10'2") turning radius and ultra-clean sweeping makes the TENNANT 100 ideal for downtown areas, alleys, parking lots, tunnels, bridges, air terminals, better residential areas . . . wherever you want *really clean sweeping!*

WRITE TODAY *for complete specifications and performance data. G. H. Tennant Company, 755D N. Lilac Drive, Minneapolis 22, Minnesota.*

TENNANT

VACUUMIZED SWEEPERS

Here's a King-Sized Sucker-Upper . . .

656. . . . that will rid your streets and gutters of leaves, litter and other bulky materials in record time. Cleans catch basins to 8-ft. depth in minutes. Bulletin PL 758 S describes and illustrates this motorized Scavenger. Address Good Roads Machinery Corp., Minerva, Ohio, or circle number on card.

Make Your Concrete Defy the Seasons.

658. A new pocket-size booklet describes and illustrates all the good things Wyandotte Calcium Chloride can do for your concreting in faster hardening, high early strength, increased final strength and workability—to name but a few. Get your copy from Wyandotte Chemicals Corp., Wyandotte, Mich., or circle the number above.

Sludge Removers for Tanks of Any Size or Type

659. The Rex Unitube Tow-Bro Sludge Remover is described as a proven standard of the industry. Bulletin 315-81 shows how Tow Bro can be applied to tanks of any size or type. Write Chain Belt Co., Milwaukee 1, Wis., or circle above number on card.

Where to Get Those Indispensable Traffic Cones

663. Why you need them, where they are most useful, with full descriptions and dimensions. Rubber or plastic, with or without adapters, flasher lights and flags. Just write for attractive four-color bulletin to Radiator Specialty Co., 1400 W. Independence Blvd., Charlotte 8, N. C., or circle above number on card.

Diesel Electric Plants Engineered for Your Needs

666. New 2, 5 and 7.5 kw Diesel plants described and illustrated in 8-page "Diesel Trio" booklet. Fuel economy and quick cold-weather starting are features you will want to know more about. Write Kohler Co., Kohler, Wis., or circle the number on card.

These Crosswalk Markings Outlast Paint 6 to 8 Times

676. Crosswalk markings of Perma-Line, the quick setting line that is easily applied, trouble-free, economical, and which outlasts paint 6 to 8 times, is described in literature of the Veon Chemical Corporation, 22-09 Bridge Plaza North, Long Island City 1, N.Y. Available in reflectorized white or yellow. Tests under your local conditions are invited.

Spiraflo Clarifiers for Water and Waste Treatment

679. 32-page Bulletin 126 available from Lakeside Engineering Corp., 222 West Adams St., Chicago 6, Ill., covers performance and design data on the efficient Spiraflo Clarifier. Check the reply card.

Boost Your Community's Leadership in Today's Boating Boom

686. How to do this is the business of Standard Steel. They invite no-obligation consultation that will include just the information you need to consider modern Marinas that attract boating dollars to your community. Address Standard Steel Products Mfg. Co., Dept. W., 2836 S. 16th St., Milwaukee 15, Wis., or check card number.

Spot the Loafers!

687. Servis Recorders do just that. Installed on street sweepers, dump trucks, refuse trucks and front loaders they make permanent tamper proof records of who and what is working and what is idle. Savings in fuel add to its economies. Write for "Off-the-Highway Bulletin," to The Service Recorder Co., 10158 Rockwell Ave., Cleveland 14, Ohio, or circle the above card number.

You are not Seeing Double

688. The Weil submersible sewage and sump pumps actually offer a choice of two motors, two controls. MICRO switch controls start and stop pumps, alternate pumps, and to provide high water alarm. Get Booklet SE-860 for complete engineering information from Weil Pump Co., 1526A N. Fremont St., Chicago 22, Ill., or circle card number.

This Mower *Hurries* to Work

693. Travels 40 mph in its eagerness to get on the job. Mows at up to 10 mph when there. Has too many desirable features to list here, so learn them all by writing for data and specifications to Topeka Hiway Mower Inc., P. O. Box 720, Topeka, Kans., or check above number on card.

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April 1960

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New Equipment Items Appear on Pages 202 to 207

4-1 4-2 4-3 4-4 4-5 4-6 4-7 4-8 4-9 4-10 4-11 4-12 4-13 4-14 4-15 4-16 4-17 4-18
4-19 4-20 4-21 4-22 4-23 4-24 4-25 4-26 4-27 4-28

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Meetings and Conventions

Association of Highway Officials of the North Atlantic States
Bellvue-Stratford
Philadelphia, Pa., Mar. 30-Apr. 1

New Jersey Section
Water Pollution Control Federation
Traymore Hotel
Atlantic City, N. J., Mar. 30-Apr. 1

New York Section, AWWA
New York Sheraton Inn
Binghamton, N. Y., Apr. 5-7

Missouri Section, AWWA, and University of Missouri Conference on
"Water Softening and Stabilization"
Columbia, Mo., Apr. 6

Kansas Section, AWWA
Broadview Hotel
Emporia, Kan., Apr. 20-22

Nebraska Section, AWWA
Cornhusker Hotel
Lincoln, Nebr., Apr. 20-22

California Section, AWWA
Mark Thomas Inn
Monterey, Calif., Apr. 22

Virginia-DC-Maryland Chapter, APWA
George Mason Hotel
Alexandria, Va., Apr. 22-23

Kansas Section
Water Pollution Control Federation
Broadview Hotel
Emporia, Kan., Apr. 22-24

Conference on Algae and Metropolitan Wastes, R. A. Taft Sanitary Engineering Center
Cincinnati, Ohio, Apr. 27-29

Arizona Section, AWWA
Pioneer Hotel
Tucson, Ariz., Apr. 28-30

Montana Section, AWWA & Water Pollution Control Federation
Northern Hotel
Billings, Mont., Apr. 28-30

Purdue Industrial Waste Conference
Purdue Memorial Union Bldg.
Lafayette, Ind., May 3-5

Pacific Northwest Section, AWWA
Benson Hotel
Portland, Ore., May 4-6

Eighth Highway Transportation Congress
Hotel Mayflower
Washington, D. C., May 10-12

National AWWA
Americana Hotel
Bal Harbour, Fla., May 15-20

Western Public Works Conference
Fresno, Calif., May 16-18

Central California Chapter, APWA
Hacienda Motel
Fresno, Calif., May 16-18

Air Pollution Control Association
Hotel Netherland-Hilton
Cincinnati, Ohio, May 22-26

National Society of Professional Engineers
Statler Hotel
Boston, Mass., June 8-11

Pennsylvania Section, AWWA
Hilton Hotel
Pittsburgh, Pa., June 14-17

Virginia Section
Water Pollution Control Federation
John Marshall Hotel
Richmond, Va., June 15-17

Central States Section
Water Pollution Control Federation
Lorraine Hotel
Madison, Wis., June 15-17

Ohio Section
Water Pollution Control Federation
Neil House
Columbus, Ohio, June 15-17

Iowa Section
Water Pollution Control Federation
Ottumwa Hotel
Ottumwa, Iowa, June 15-17

ASTM
Chalfonte-Haddon Hall
Atlantic City, N. J., June 26-July 1

American Public Works Association
The Coliseum
New York, N. Y., Aug. 14-17

Institute of Traffic Engineers
Edgewater Beach Hotel
Chicago, Ill., Sep. 11-15

Water Pollution Control Federation
Philadelphia Sheraton Hotel
Philadelphia, Pa., Oct. 2-6

American Public Health Association
San Francisco, Calif., Oct. 31-Nov. 4

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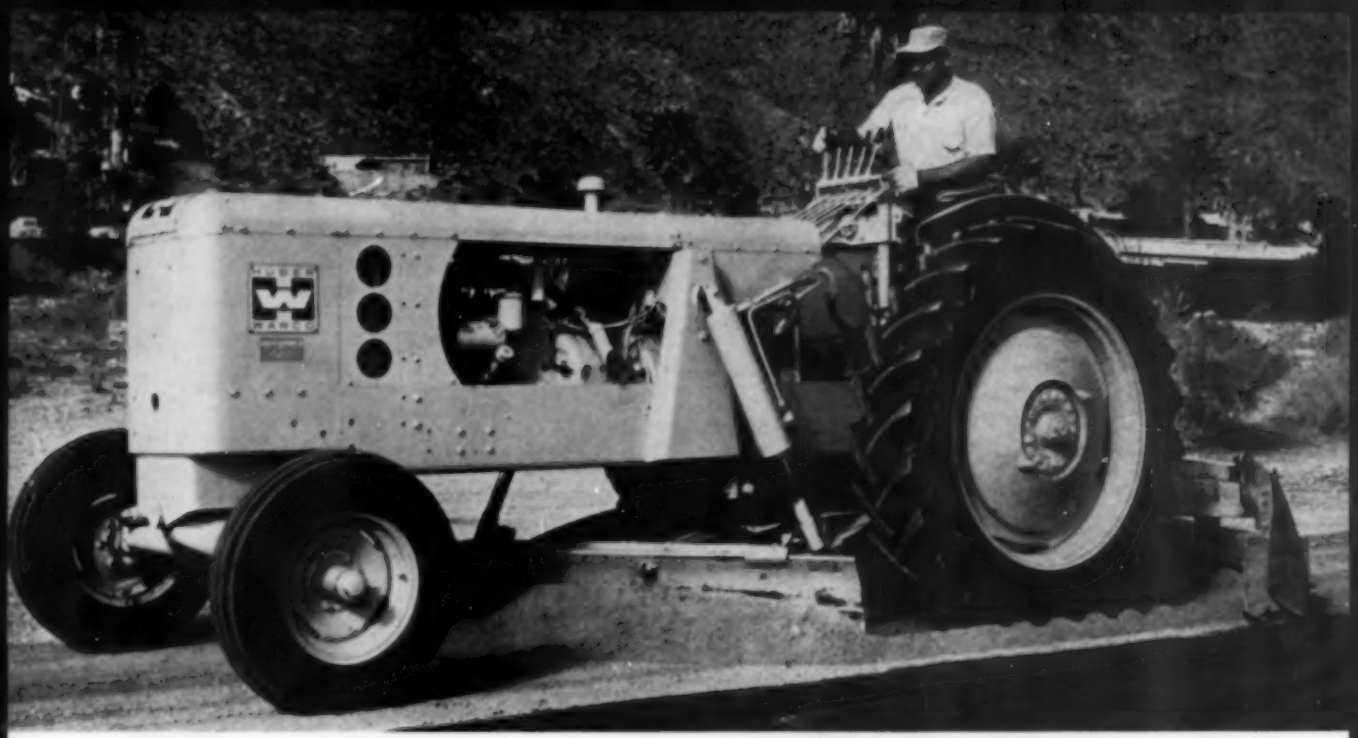

PALM SPRINGS, CALIFORNIA uses its Huber-Warco Maintainer with berm leveler attachment on street maintenance. In one single operation it grades and levels berms which previously required two passes of their larger motor grader.

HUBER WARCO

HUBER-WARCO *maintainers*

"Nine Machines In One"

VERSATILITY and year 'round performance are two important benefits of a Huber-Warco Maintainer. The basic machine has a nine-foot power sliding moldboard for routine grading work. Hydraulic controlled attachments quickly convert the Maintainer for service as Bulldozer, Lift-Loader, Scarifier, Berm Leveler, Side Dozer, Broom, Patch Roller and Snow Plow.

TORQUE CONVERTER combined with 45½ H.P. gasoline engine gives plenty of power for toughest jobs. Converter reduces shock loads, prolongs machine life, increases work capacity and cuts fuel consumption.

WORKING SPEEDS range from 1.7 to 8 M.P.H. Travel speed is 21 M.P.H. for quick movement between jobs. Weight is 6,250 lbs.—7,205 lbs. with calcium chloride in tires.

A complete line of optional equipment, in addition to the hydraulic attachments, is available for the Maintainer.

A trusted product name backed by respected distributor names from coast to coast

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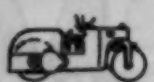
Standard transmission models from 83 to 160 H.P. Torque converter and power shift transmission models from 102 to 195 H.P.



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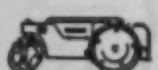
3-5 Ton • 4-6 Ton Retractable • 5-8 Ton • 8-10 Ton • 8-12 Ton • 10-14 Ton



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10-Ton • 12-Ton • 14-Ton Standard Weight 10-12 Ton • 12-14 Ton Variable Weight

MAINTAINER

M-52 — 45½ H.P. Attachments are Lift-Loader, Broom, Bulldozer, Patch Roller, Scarifier, Snow Plow, Berm Leveler

HUBER-WARCO COMPANY Marion, Ohio, U.S.A.

To order these helpful booklets check the reply card opposite page 34.

Keep Communication Right Under Your Hat . . .

567. with this new-type miniature 2-way transistorized radio system. With it you are never out of touch with jobs or personnel. TELEPATH Systems can be worn like clothing. No license required for 27 mc type. Write for literature to SEISCOR, Box 1590, Tulsa, Okla.

Literature on Reflective Glass Beads

571. Glass beads for traffic signs and street name signs are described in literature available from FLEX-O-LITE MFG. CORP., 8301 FLEX-O-LITE DRIVE, P. O. Box 3066 (Affton Br.) St. Louis 23, Mo. No. 831 high index of refraction glass beads for white and yellow backgrounds and UB 68 medium index of refraction glass beads for reflectorizing dark colors such as red, green, blue, etc.

Measure Water Accurately In Open Ditches and Channels

694. Parshall Measuring Flumes are widely used by Irrigation Companies, Farmers, Cities and Industries. All steel construction assures accuracy within 2%. Available in sizes for 0.1 to 1340.0 cubic feet per second. Catalog B-31-C contains free-flow discharge tables, sizes, capacities and weights. Thompson Pipe & Steel Co., 3025 Larimer Street, Denver 1, Colorado will send you a free copy for the asking.

Literature on Concrete Gunning Equipment

695. The application of gunned concrete and allied equipment used for mixing the dry blend mix for this operation is described in Form No. C7-59, furnished by the Air Placement Equipment Company, 1000 West 25th Street, Kansas City 8, Missouri.

Catalog on Utility Bodies and Equipment

698. General Service Bodies; Maintenance Bodies; Line Construction Bodies; Mechanical and Hydraulic Aerial Ladders; SKY-MASTERS (Aerial Devices); Winches; Hydraulic Derricks; Pole Trailers; Hydraulic Cable Reel Trailers; and Related Accessory Items of Equipment. Write McCabe-Powers Body Co., 5900 N. Broadway, St. Louis 15, Mo.

WATER WORKS

Equipment For Water, Sewage and Industrial Waste Treatment

24. The complete line of Jeffrey equipment for treatment plants is covered in a 64-page Catalog 952 available from The Jeffrey Mfg. Co., Columbus 16, Ohio. Check the reply card for information on bar and disc type screens, traveling water screens, grinders, grit collectors, garbage grinders, sludge, draw-off valves, chemical feeders, bucket elevators and scum removers to mention some of the equipment.

How Eleven Cities Installed Water Meters

56. This 8-page bulletin describes the planning and operational procedures used by 11 water departments and companies in the installation of about 200,000 water meters. Check the reply card or write The Ford Meter Box Company, Inc., Wabash, Ind., for methods of installation and rate cards

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews and R. D. Wood fire hydrant and R. D. Wood gate valves.

Automatic Engine Control Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill.

Elevated Tanks and Other Storage Facilities

32. Specification sheet covering elevated tank sizes and design and illustrated brochure available from the Darby Corp., Kansas City 15, Kansas.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Information on Service, Valve, Roadway and Meter Boxes

122. Literature on specifications covering "Buffalo" service, valve, roadway and meter boxes, and adjustable valve boxes for water and gas has just been released from Buffalo Pipe & Foundry Corp, Box 33-Station B, Buffalo 7, N. Y. Check the reply card for your information on these valve boxes.

For Holidays that are Not Fun

127. Holidays on pipe coatings, that is, find out what these Holiday Detectors can do to spot actual or potential trouble in buried pipe. Surprisingly simple and efficient. Get the full facts by writing for literature, to Tinker & Rasor, Box 281, San Gabriel, Calif., or circle our card-number for us to get it for you.

When You Need Water Stops

129. Have all the facts as contained in free 43-page book MRG 622 of the Gates Rubber Co., 999 So. Broadway, Denver, Colo. Ask them for it, or we will get it for you if you circle their number on card herein.

Brass Goods for the Water Works of America

130. The McDonald line goes all the way from curb stops to gooseneeks, corporation stops, couplings—everything pertaining to service connections. Catalog B 100 and PB 60 with much valuable data available from A. Y. McDonald Mfg. Co., 12th & Pine St., Dubuque, Iowa.

ALL "SHOOK UP" DECIDING ON AN AIR COMPRESSOR?

Take "Hardrock Smitty's" advice and

GO SMITH!

There's a complete line of Smith compressors ranging in size from 45 cfm to 125 cfm in both portable and stationary models. The Smith compressor is designed and built to deliver years of trouble free service under all conditions.

- low initial cost
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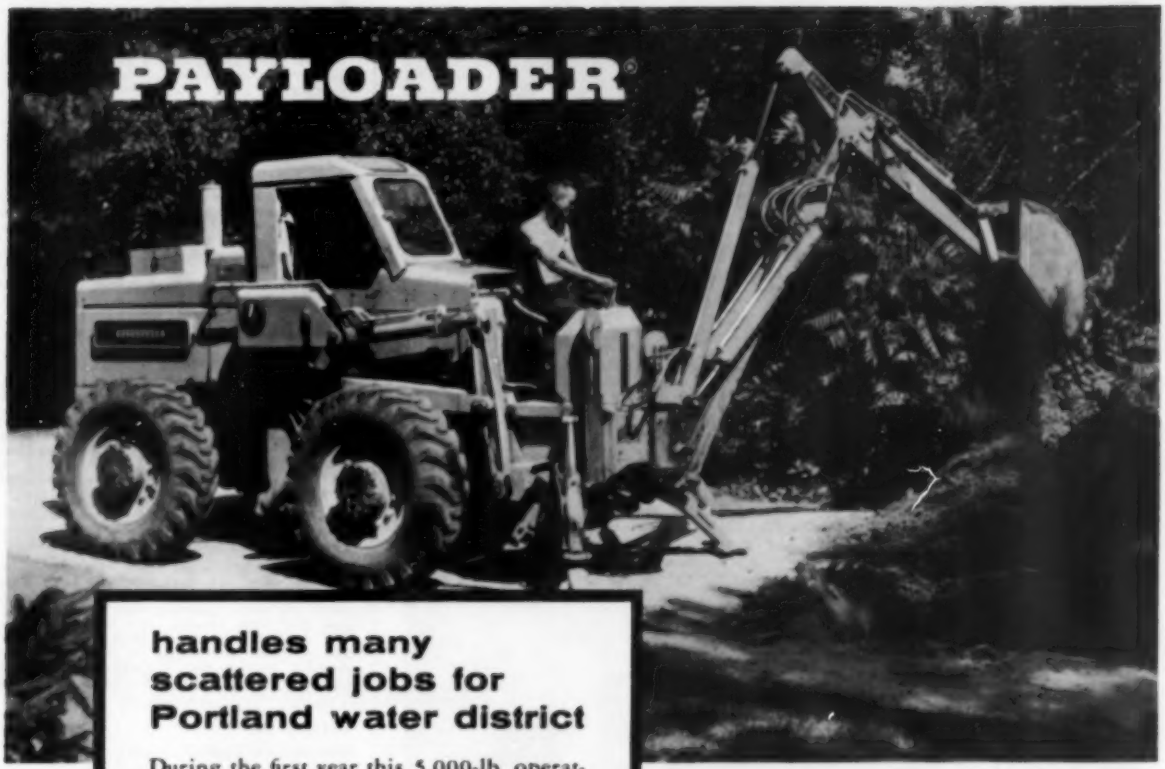
Compare price . . . compare job results you'll go Smith!

SMITH AIR COMPRESSORS

GORDON SMITH & COMPANY, INC., Bowling Green, Ky.

Ask your dealer for an "on the job" demonstration. (write us for complete information and the name of your nearest dealer)



Front-mounted Hough-Wain-Roy back-hoe has maximum reach of 12'-8" below grade; digs and dumps a full 90° right or left—enables it to operate in congested areas with minimum interference to passing traffic.

handles many scattered jobs for Portland water district

During the first year this 5,000-lb. operating capacity "PAYLOADER" tractor-shovel was owned by the Portland (Maine) Water District it was used exclusively as a loader for clean-up work. At that point, however, the real value of this versatile machine was "discovered" . . . . *easily interchanged attachments make* "PAYLOADER" *the most useable equipment available today!*

A Hough-Wain-Roy hydraulic back-hoe was obtained for their "PAYLOADER" and, as Supt. J. P. Hennings of the Portland District says, "We find the bucket to back-hoe or vice-versa change-over fast and very easy". Mobility of the "PAYLOADER" "is another big advantage in our work . . . we use it chiefly in jobs involving less than 100 lineal feet of excavation and frequent changes of location are required. We also find this unit takes up less space in the street during operation."

Recently, on a 1,000-ft. street widening project, the "PAYLOADER"-back-hoe combination installed 24-ft. trenches, 5-ft. deep and 24-in. wide, to replace old laterals. After the pipe was laid, a back-fill blade was attached to the hoe so the "PAYLOADER" was able to take care of the entire back-filling operation too.

For even more "PAYLOADER" usefulness, check this list of available attachments: Drott 4-in-1 bucket, black-top spreader, street sweeper, leaf loader, side boom, rotary, "V" and blade plows. See your nearby Hough Distributor for complete details.

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761 Sunnyside Avenue, Libertyville, Ill.

Please send data on complete "PAYLOADER" line and attachments.

Name _____

Title _____

Gov't. Unit _____

Street _____

City _____ State _____

4-8-3

To order these helpful booklets check the reply card opposite page 34.

PERMA-LINE

This is what makes thermoplastic PERMA-LINE different from old fashioned marking methods: *It's there when you need it most*, whatever the season.

For long lines or crosswalks, in any climate, PERMA-LINE is unsurpassed for high visibility, durability and *guaranteed* safety protection.

PERMA-LINE applies with amazing speed. It dries almost instantly, without disrupting traffic. That's why modern, all-season PERMA-LINE—and only PERMA-LINE—can meet the strict standards of safety demanded by the new Interstate Highway System.

For economy and permanence, Traffic Engineers know: "Whatever the season, if there is a reason for *any* safety marking, there is a better reason for PERMA-LINE."

perma-line

VEON CHEMICAL CORPORATION • 22-09 BRIDGE PLAZA NORTH • LONG ISLAND CITY 1, N.Y.

For your free copy of our brochure showing latest installations and specifications, return this coupon.

NAME _____ TITLE _____

ADDRESS _____

CITY _____ STATE _____

Here's a New Note in Filter Cleaning Equipment

202. Just announced, a new S-Type Filter Arm that is reported to increase filter cleaning efficiency by 25 to 30%. Doubles the agitating impulses and improves your plant performance strikingly. Adaptable to present installations, too. Write Palmer Filter Equipment Co., Erie, Penn., or circle reply card.

U. S. Tyton Joint Pipe

210. An eight page booklet on centrifugally cast, Tyton Joint® pipe for water or other liquids is available. Tyton Joint cast iron pipe is provided with a simple, sturdy and tight slip-on type of joint. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co., Birmingham 2, Ala., or check the reply card.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 51 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Bell and Spigot Joint Leaks Quickly Repaired

214. Broken water main can quickly be repaired when you have "Skinner-Seal" Split Coupling Clamps on hand. Leaky bell and spigot joints are made lastingly tight with Skinner-Seal Bell Joint Clamps. Get Skinner Catalog GW now—this handsome 48-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily. M. B. Skinner & Co., South Bend 21, Ind.

Catalog on Dewatering Pumps

226. Centrifugal and diaphragm pumps for dewatering jobs are described in Catalog DP7 from The Jaeger Machine Co., 550 West Spring St., Columbus 16, O. Models, specifications and performance tables are included. Check the reply card.

Clow Bell-Tite Cast Iron Pipe

280. Laying water mains is easier, faster and more economical with Clow Bell-Tite joint cast iron pipe. Joint employs a single rubber gasket as the only accessory. Complete details available in illustrated literature from James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

Waterworks and Municipal Castings

293. Meter boxes and covers, yokes and couplings, service boxes and manhole covers are covered in 24-page catalog. Check the reply card or write H. W. Clark Co., Mattoon, Ill., for full specifications.

Do You Know the Value of the V-Notch?

295. A new booklet tells what you want to know about how chlorine feeding can be made as regular and precise as the sunrise. Ask for "The V-Notch Story" direct of Wallace & Tiernan Inc., 23 Main St., Belleville 9, N. J., or check the card-number.

There's More than One Way to Dig a Trench

318. Arps Corporation lets you choose. The ARPS tractor-mounted Trench Hog makes it cheaper, better to own your own trencher. Digs to 7 feet deep, 20" wide. Trench-Devil M-A has 7 appealing new features. Smaller Trench-Devil Jr. keeps you from sending a man to do a boy's work. Write Arps Corp., New Holstein, Wis. or check the card for bulletins.

Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, and end suction centrifugal pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., 636 Loucks St., Aurora, Ill. Included is a pump selection guide and spigot pipe. Check the reply card.

over 15 KWH per gallon

For the past three years, Consumers Public Service Company of Brookfield, Mo., has achieved remarkable fuel economy with a White Superior Model 80-SX-8 engine-generator package installed at Princeton. The Superior is rated 1440 HP at 360 RPM and drives a generator of 1000 KW capacity. This dependable combination produces over 15 KWH of electricity per gallon of fuel oil, which is 15-25% more power per gallon than comparable engine-generators commonly produce!

** Superior 80-SX-8 Diesel at Princeton, Missouri, produces 15-25% more power per gallon fuel oil than comparable engine-generators!*

Superior's highly developed open chamber combustion system and a competitively-aimed series of exclusive design developments and refinements account for this thrifty performance. Moreover, the high KWH/gallon will remain consistent, because Superior is a rugged, heavy-duty, low-speed engine. It will not eventually "loosen up"—like lightweight, high-speed engines often do—causing a gradual drop in power output per gallon. Superior's economical operation goes far beyond fuel savings, too. Extreme design simplicity eliminates high mortality parts . . . means fewer replacement parts required, reducing maintenance and repair to a minimum.

Model 60 and 80 Stationary Diesels, six or eight cylinder, can be furnished as diesel, dual-fuel or gas engines. They are one segment of a complete line of Superior engines ranging from 190 to 2150 HP, or 150 to 1500 KW. White can custom-engineer a Superior to your exact requirements and apply its extensive experience with automatic, unattended and remote control operations to your problem!

Superior ENGINES ATLAS Imperial DIESEL ENGINES White DIESEL

White Diesel

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY
Plant and General Offices: Springfield, Ohio

To order these helpful booklets check the reply card opposite page 34.

Never Mind Your Lagoon Depth

326. If you want to get air into any aeration basin or lagoon the "VORTAIR" Aerator will do it. It's no power hog, either. Dissolves 2.5 to 3 lbs. of oxygen per hour per hp. Bulletin 6620 from Infilco Inc., Tucson, Ariz., or check card.

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 23, Wisconsin.

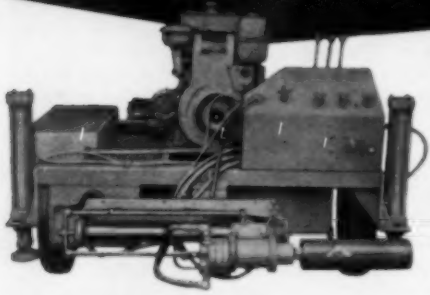
385-HP Engine For Standby Pumps and Generator Sets

372. International 385-hp compact heavy-duty 4-cycle, 6-cylinder engine is well illustrated in literature from International Construction Equipment, International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill. Check the reply card for full specifications.

Trenchers for Water and Sewer Line Construction

384. Three Cleveland J trenchers incorporating major advances in trencher design and operating advantages are described in Bulletin L-104 available from The Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio. Check the reply card for digging capacities, specifications and dimensions.

specify **MOBILE**
hydraulic powered DRILLS
for *speed, power, economy...*



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MARK V

It's the only diamond coring machine designed and built specifically for *production-type* concrete test coring on highways, aircraft runways and other slab-type masonry structures. Also available without custom-built trailer for mounting on ¼ ton utility truck.

MOBILE DRILL

DIGGER

Production type earth auger bores holes for utility poles, guard rails and similar installations with lightning speed.

MOBILE DRILL **B-40 EXPLORER**

Lightweight B-40 core drills to 250' and augers to 100'. It's a natural for diversified soils exploratory work and all-round utility.

MOBILE DRILL **MARK IV**

Diamond masonry drilling machine has exclusive *automatic hydraulic feed*. It's lightweight, portable, easy to use.

Mobile offers a complete line of hydraulic rotary drilling machines, soil sampling equipment, diamond masonry coring machines, diamond bits, drilling tools and equipment.

MOBILE DRILLING, Inc.
960 N. Pennsylvania Street • Dept. 10
Indianapolis 4, Indiana

Book Tells How to Control Algae

371. Details on the control of various microscopic organisms frequently found in water supplies are furnished in a 44-page booklet offered by Phelps Dodge Refining Co., 300 Park Ave., New York 22, N. Y. Check the reply card.

Who Says Water Tanks Stand Still?

378. Not in design they don't. For the latest developments in Horton steel reservoirs and standpipes it is time now to write for new bulletin, liberally illustrated and with table of standard tank dimensions, to Chicago Bridge & Iron Co., 332 South Michigan Ave., Chicago 4, Ill., or check the card number.

A New Note in Waterworks Brass Goods

492. The Hays line covers everything from curb stops to tapping machines. Beautifully illustrated catalog is packed with information to help you buy the best. To get your copy write Hays Mfg. Co., Erie, Pa., or check the card.

Manual on the Hersey Disc Water Meter

521. Illustrations, descriptions and specifications of Hersey Water Meters are covered in Manual from Hersey-Sparkling Meter Company, 250 Elm Street, Dedham, Mass. Size ranges are 2" through 10". Disc, Compound (C1), Fire Service (FM) and Current (T) Meters. Check the reply card.

When You Measure Don't Lose Your Head

544. Head of water pressure, that is. There's a new propeller meter now, dedicated to just that. A new Bulletin, MR-105 tells how. You get it by writing Measure-Rite, Incorporated, a subsidiary of Badger Meter Mfg. Company, 701 S. Garfield Ave., Alhambra, Calif., or circling our card.

Diatomite Filters in Water Filtration

396. A new line of IWF diatomite filters is featured in this 10-page Bulletin 651 by the R. P. Adams Co., Inc., 328 East Park Drive, Buffalo 17, N. Y. The IWF is ideal for medium and small town water supplies and the bulletin provides installation drawings, sectional views and operational sketches.

Water Service Hydrants and Outdoor Drinking Fountains

661. Water service hydrants in 4 sizes, ¾", 1", 1½" and 2" and all types of outdoor drinking fountains are described in a well-illustrated, 24-page catalog from The Murdock Mfg. & Supply Co., 426-30 Plum St., Cincinnati 2, O.

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours and weighs only four lbs. when completely assembled is described in literature from Wilkinson Products Co., 3067 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

Bulletin Covers Step-by-Step Action on the Water Problem

689. A step-by-step outline of action telling how the responsible citizens can help their officials extend and improve the local water system through more adequate rate structures on financing is covered in this bulletin available from Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois.

Water Filtration Costs Can Be Reduced

692. The "Celite" system of diatomite filtration makes possible reduced installation cost, with space requirements a fraction of those for equivalent sand filtration. For informative literature write Johns-Manville, Box 14, New York 16, N.Y.

Mueller Drilling, Tapping and Inserting Machine

696. The Mueller B-100 double pressure chamber tapping machine makes faster taps, assures pressure tight connections and can be used by hand or with power. Check the reply card or write Mueller Co., Decatur, Ill.

To order these helpful booklets check the reply card opposite page 34.

SEWERAGE AND WASTE TREATMENT

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

Controls for Water and Sewage Pumps

428. Condensed data sheet gives you valuable information on applications and operation of Roto-Trol controls. Before you design automation in pump service, write Healy-Ruff Co., 2255 University Ave., St. Paul 14, Minn., or check card number.

Torque-Flow Sewage Pump For All Phases of Sewage Treatment

496. Bulletin No. P10-B26 describes the operation of the Wemco torque-flow sewage pump and covers typical installation set-ups. Check the reply card or write Western Machinery Co., 650 Fifth St., San Francisco, Calif., for complete details.

Complete Treatment Unit for Handling Flows to 0.5 MGD

503. Developed for sewage flow characteristics of small communities, the Aerator-Clarifier is a complete treatment unit utilizing automatic balance of activated sludge solids with sewage flow. Bulletin 129, issued by the Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill., describes application of this unit. Check the reply card.

Gas and Gasoline Engines Described in Literature

535. Redline engines (formerly LeRoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

Putting Small Sewage Treatment Plants in the "Big Time"

537. Four equipment units that get big plant results in small plant operation are featured in an 8-page booklet "Small Plant Sewage Treatment." Drawings and flow sheets give the details. Write Dorr-Oliver Inc., Stamford, Conn. for Bulletin 6692 or use the reply card.

Technical Bulletins to Design or Check by . . .

600. for water and sewage plants. They are now available as No. 100 on Venturi tubes; No. 720 on supervisory control; No. 1003 on mechanically operated rate-of-flow and loss-of-head gauges; No. 1004 on pneumatic single and double indicating receivers; and No. 1225 on controlled closing air valves. For the set, write Simplex Valve and Meter Co., Lancaster, Pa., or circle our card number.

A Breakthrough in Vacuum Filtration

622. To bring you up-to-date on the Eimco continuous belt drum filter, this new booklet covers design, application and actual case histories. Sewage plant designing engineers will find it highly useful. Write The Eimco Corp., 634-666 South 4th West St., Salt Lake City 10, Utah, or circle the number on our card.

From Sludge to Ashes

636. A process described in attractive detail in this new brochure on sludge handling and incineration in sewage plants with Nichols Herreshoff Multiple Hearth Sludge Furnaces. Your copy of this No. 238 bulletin may be had by writing Nichols Engineering & Research Corp., 80 Pine St., New York 5, New York.

Catalog on Steel Grating

665. New ideas in flooring, walkways, stair treads, platforms and shelving are covered in Catalog 2527R available from Blaw-Knox Co., Dept. W., Pittsburgh 38, Pa. Check the reply card for information on choice of cross bar and bearing bar designs and spacings.

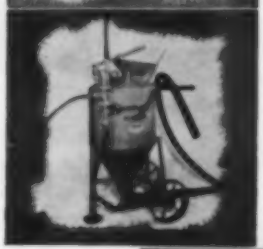
Public Works Officials in Many Cities, Counties, States and Provinces

MAKE BUDGET DOLLARS DO MORE WITH AIRPLACO CONCRETE GUNNING EQUIPMENT

When the Job Calls for Concrete . . . Call for AIRPLACO

AIRPLACO CONCRETE GUNS for Restoration and Repair of Roads, Streets, Bridges, Culverts, etc. Choose from six different models in a complete line of concrete guns. Whatever your production requirements—from ½ to 8 cu. yds. per hour—there is an AIRPLACO BONDACTOR or NUCRETOR to meet your needs.

AIRPLACO MIX-ELVATORS for Faster, Easier Proportioning, Mixing, Elevating and Screening. Choose from three models. Capacity up to 12 yds. per hour.



AIRPLACO GROUTER AND PLACER for Easy-to-Use, Versatile Grouting and Placing of Concrete and Other Materials.

The portable Model G-6 Grouter and CP-10 Placer is ideal for soil stabilization, tunnel backfilling, filling hard to get to forms, etc. Both the G-6 and CP-10 have capacities of up to 5 cu. yds. or more depending on materials used and job conditions.

AIRPLACO JET-BLASTERS For Low-Cost, Easy-to-Use Sandblasting (wet or dry). The Model B-6 single charge (650-lb. capacity) and B-3C continuous feed (500-lb. capacity) Jet-Blasters are designed to handle all abrasive materials for cleaning, polishing, or etching of any type of surface. Jet-Blasters are available with accessories for wet or dry blasting and new exclusive "Sand-Saver" remote cut-off valve.

Let Us Help You Solve Your Concrete Problems

Our experience in solving unique problems involving the handling of concrete has saved thousands of dollars for others. This experience is available to you. Write, wire or phone us, anytime.

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WORLD'S LEADING MANUFACTURER OF "ADVANCED DESIGN" PNEUMATIC PLACING EQUIPMENT

To order these helpful booklets check the reply card opposite page 34.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay underdrain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

Entirely New Small Sewage Treatment Plant

40. The Sparjair units are package type plants that range in size from a 50 population equivalent to 5000 and utilize the contact stabilization process to produce a clear, nuisance free effluent. Copies of Bulletin 19-S-94 are available from Walker Process, P. O. Box 266, Aurora, Ill., or check the reply card.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

Protective Lining for Concrete Pipe and Structures

131. T-Lock Amer-Plate is a tough, long-lasting acid-resistant vinyl sheet lining for concrete pipe and structures which are exposed to corrosive materials. T-shaped ribs pressed in the sheet are embedded in the concrete as it is poured to lock the lining permanently in place. Get full details from Amercoat Corp., South Gate, Calif., or check the reply card for illustrated folder.

The Submersible Pump You have Been Waiting For

141. Electric, fully submersible, portable, runs dry without damage, no priming, and other outstanding advantages. All are described in Flygt Bulletin B-80L of Flygt Corp., Hoosick Falls, N. Y. Address them or just circle the number on our card.

Stationary Diesels For Water and Sewage Plants

167. Engines are four-cycle, 6 or 8 cylinder, in-line models, ranging from 190 to 2150 bhp and from 135 to 1500 KW, are available either naturally aspirated or supercharged, and can be furnished to run as diesel, dual-fuel or gas engines. For Bulletin #115A check the reply card or write White Diesel Engine Div., The White Motor Co., Springfield, Ohio.

Catalog on the Flynn and Emrich Incinerator Stokers

180. This catalog describes the Flynn and Emrich Incinerator stokers as to design, feeding capacities and loadings. Plenty of drawings of the stokers and photographs of incinerator plants under construction and in operation are included. Also, there is a good section on the incinerator history. Check reply card for catalog No. 1702 from Flynn and Emrich Co., Holiday and Saratoga Sts., Baltimore 2, Md.

Now You Can Switch One or Two Men to Other Work

216. . . . if you are doing bucket sewer cleaning with old-fashioned machines. The Flexible Truck-Loder eliminates dumping, shoveling and street cleaning. Debris goes direct from sewer to truck. Catalog 59-Z tells all about it. Address Flexible Inc., 3786 Durango Ave., Los Angeles 34, Calif., or check the card.

Fibre Pipe For Sewer Lines and Septic Tank Connections

222. Bermico bituminized fibre pipe is lightweight, rootproof and easy-to-install. Check the reply card or write Brown Co., 150 Causeway St., Boston 14 Mass., for full details.

Engineering Data Manual on Underground Lift Stations

218. This 100 page manual includes descriptive bulletins, specifications covering typical installations for pump type or ejector type stations, friction loss tables covering capacities and size of pipe, pump and motor selection charts and wiring diagrams. Check the reply card or write Smith & Loveless, Division-Union Tank Car Co., Lenexa, Kansas.

Packaged Engineering Data on Packaged Lift Stations

238. Help on sewage pumping problems is available in new bulletins which cover packaged pump stations, pneumatic lift stations and pneumatic ejectors. Write to Tex-Vit Supply Co., Mfg. Div., Mineral Wells, Texas, or check the card.

Gravity Sewer Pipe Engineering Classifications

305. A quick method for choosing the most economical class of asbestos-cement sewer pipe to suit each laying condition with handy crushing table based on the Marston formula is available from Keasbey & Mattison Co., Ambler, Penna. Check the reply card.

Roots Seeking Entry into Your Sewers

315. . . . give up in despair when confronted with pipe joints made with Atlas JC-60 plastic base sewer joint compound. Engineering data are presented in Bulletin M20-3. For your copy write Atlas Mineral Products Co., Mertztown, Pa., or check our card.

Engineering Data on Gas Safety Equipment

343. P.F.T. Gas Safety Equipment for Controlled Digestion is the subject of an excellent 12-page bulletin issued by Pacific Flush Tank Co., Chicago 13, Ill. Full engineering data on flame traps, pressure releases, waste gas burners and related equipment is provided in convenient form. Requests for this valuable booklet must be made on business letterhead.

SPEED SENSITIVE

1, 2 & 3 ELEMENT SWITCHES

OVERSPEED

One S. P. D. T. switch to trip at speeds between 500 and 6,000 RPM.

OVER AND UNDERSPEEDS

Two S.P.D.T. switches to trip at two different speeds between 300 and 6,000 RPM.

UNDERSPEED

One S. P. D. T. switch to trip at speeds as low as 250 RPM. Maximum operating speed 5,000 RPM.

OVER INTERMEDIATE AND UNDERSPEED

Three S.P.D.T. switches to trip at three different speeds between 350 and 6,000 RPM.

EXPLOSION PROOF AVAILABLE

The switches listed above are available with explosion proof containers that meet all of the specifications of Class 1, Group D, explosion proof equipment.

For further information ask for Bulletin 504 and 504 A.

SYNCHRO-START PRODUCTS, INC.
8151 N. RIDGEWAY AVE., SKOKIE, ILL.

"HANDY" SPREADER
spreads Sand, Gravel, Slag and Salt

Spreads aggregate from powder fine to 3" depths.

Automatic Transmission operates forward or reverse without shifting gears.

The Good Roads "Handy" Aggregate Spreader is designed for smooth and accurate spreading of sand, slag, stone, gravel, calcium-chloride, etc., up to 1" in diameter—from powder fine to 3-inch depths.

Ideal for parking lot, street, road, highway construction and maintenance, it is available in 6 models for spread widths of 8, 9, 10, 11, 12, and 13 feet. Narrower widths can be accomplished by use of block-off plates.

For complete details see your local distributor, or write to:

GOOD ROADS MACHINERY Corp.
MINERVA, OHIO

8 out of 10 Sanitary Engineers assure

water-tight pipe joints

by using

TYLOX *flexible* GASKETS

There are more TYLOX Rubber and Neoprene Gaskets in low head service than all other types of gaskets combined! . . . Most waste disposal designers specify TYLOX Gaskets, knowing from experience that they prevent water from leaking *in* or *out* of pipe joints. The diagram below of a TYLOX Type "A" Gasket on straight T & G pipe shows how . . .

Whether you are planning pipe lines of B & S, T & G, offset or recessed pipe of *any* size, there's a Tylox Rubber or Neoprene Gasket in the Hamilton Kent family of true compression Gaskets to make the joints water-tight for the life of the pipe itself. If you are not already thoroughly familiar with the advantages of TYLOX Gaskets, write for full information and engineering details.

TYLOX prevents joint leakage with a compression-tight seal. It reduces pipe-laying costs with quick assembly and fast pipe coupling. Acid-resistant, TYLOX never deteriorates.

This TYLOX GASKETED PIPE is being used on the following sewer installation:

PROJECT: West Side Trunk Sewer, West Side Sanitary District, County of Onondaga, New York, Onondaga Public Works Commission.

ENGINEERS: O'Brien & Gere, Consulting Engineers, Syracuse, N. Y.

CONTRACTOR: M. A. Bongiovanni, Inc., Syracuse, N. Y.

PIPE: Reinforced Concrete T & G Pipe, Manufactured by American-Marietta Company, Concrete Products Division, Syracuse District, Syracuse, N. Y.

HAMILTON KENT
MANUFACTURING COMPANY
KENT, OHIO
427 West Grant St. ORchard 3-9555

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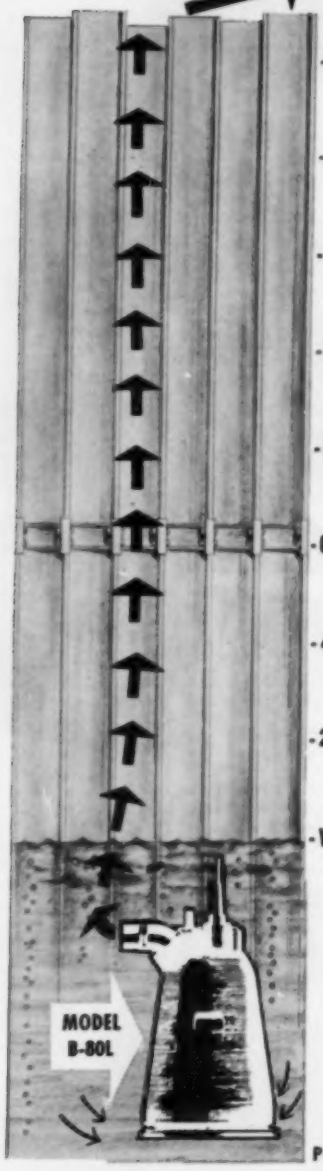
CANADIAN PLANT: 10 Brussels St., New Toronto, Ont., Phone CLifford 1-2494

THIS ...Is Modern Performance by FLYGT!

ELECTRIC SUBMERSIBLE PUMPS

170 FOOT HEAD • HIGHER IN TANDEM



One drainage job. One 3" Flygt pump. Put them together and you've got action — 340 GPM at discharge; heads to 170 feet or higher in tandem. This is typical performance from Flygt — the only pump that can cut your pumping costs — handle your drainage and dewatering jobs in less time. All other models in the Flygt line, ranging in discharge sizes from 1½" to 8", and capacities to 3100 GPM with heads to 220 ft., give comparable excellent performances. Flygt electric submersible pumps are solving difficult water problems on thousands of jobs all over the world. Fully portable, they go right in the water — start pumping immediately, giving day and night performance without supervision and only occasional inspection. Rugged, simple, fool-proof, economical — Flygt pumps are the modern approach to drainage and dewatering. Get to know Flygt by writing for illustrated brochure, then ask your local distributor for an on-the-job demonstration.

FLYGT

87-6

STENBERG MANUFACTURING CORPORATION

HOOSICK FALLS, N. Y.

WESTERN SALES & SERVICE: STANCO MFGS. & SALES INC., 1866 Ninth St. (Corner of Olympic) Santa Monica, Calif.

PUMP BETTER ELECTRICALLY—USE FLYGT!

Incinerators for the Disposal of Combustible Wastes

217. Bulletin 179 from the Morse Boulger Inc., New York 17, N. Y. describes fully the basic principles of incineration as to combustion, auxiliary burners, draft and control and elimination of fly ash. Specifications and design of incinerators and hopper doors are included.

Manual on Solving Drainage Problems

645. An 80-page Manual on the problems of drainage and drainage materials is available. Design section includes determining culvert lengths and sizes, run-off calculations, excavation of base and backfilling data. Check the reply card or write Bethlehem Steel Co., Bethlehem, Pa., for the third revision of this valuable book containing new tables for evaluating flow friction.

•

STREETS AND HIGHWAYS

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

Don't Stand There Figuring!

51. Use the new Forney PSI Calculator "slide rule" for concrete products that includes instant conversion data from total load to psi on 17 standard test specimens and masonry units. Pocket size. Free. Address Forney's Inc., Tester Div., Box 310, New Castle, Pa.

Useful Attachments for "Payloader" Tractor Shovels

95. Increased versatility for Hough "Payloader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc.

Don't Send a Man to do a Boy's Work

108. Look into the SJ Maintenance distributor designed specifically for paving jobs where using bigger equipment would be impractical and uneconomical. Yet the SJ can be diverted to projects as big as construction of secondary roads. Why not find out about it by writing Standard Steel Works, North Kansas City, Mo., or just circle number on the card.

Eats 'Em Alive

136. Whether your materials reduction problem is concerned with refuse, garbage, tree branches, old tires, or what not, there's an M & M Hog that can chew it up into easily handleable shape. Catalog H 854 tells all about it. For yours write Mitts & Merrill Co., 1009 So. Water St., Saginaw, Mich., or just circle the number on card.

Soil Sampling Equipment for Dams, Bridges, Highways and Airports

142. Bulletin 300, available from Sprague & Henwood, Inc., Scranton 2, Pa., illustrates and describes their complete line of soil sampling equipment and their Model PD & PDH soil sampling rigs. Check the reply card for data on sampling equipment.

Damaged Barricades Can Be Repaired With PM Barricade Kits

163. PM barricade kits provide a flexible replacement system for damaged barricades. Check the reply card or write Pacific Mercury, 13232 Leadwell, No. Hollywood 9, Calif., for details on PM transistor neon or incandescent flasher warning lights.

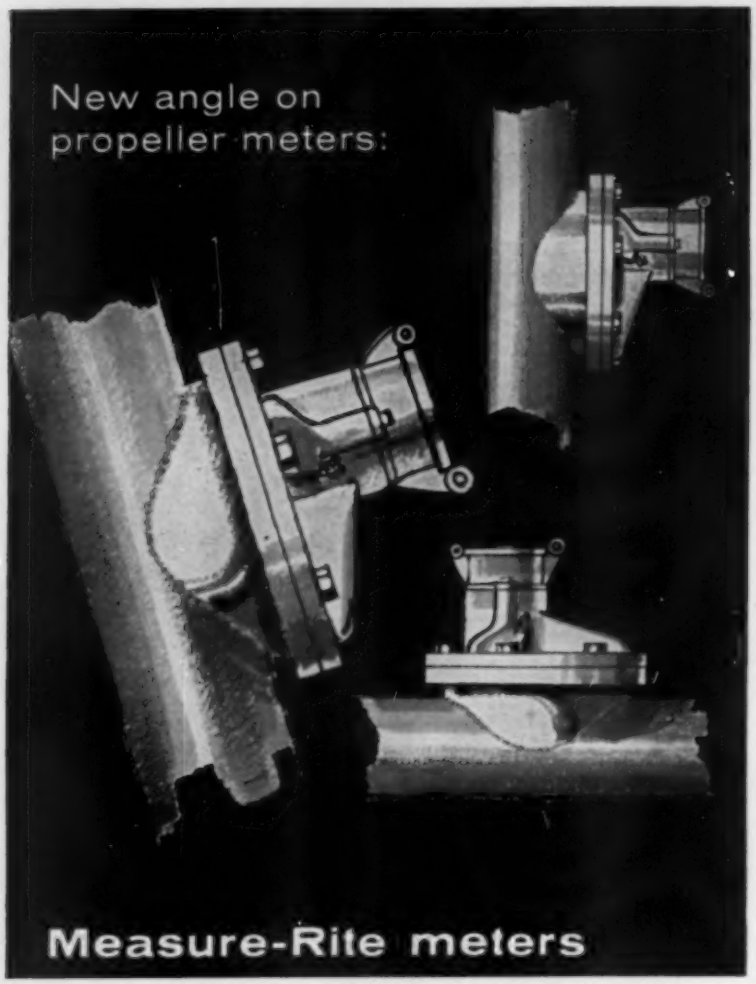
The Name is Clark

229. . . . The product is a line of Tractor Scrapers, Dozers and Shovels that make your operators happy with powerful heavy-duty equipment, engineered for fast performance on tough jobs. For full details address Clark Equipment Co., Construction Machinery Div., Benton Harbor, Mich., or check our card.

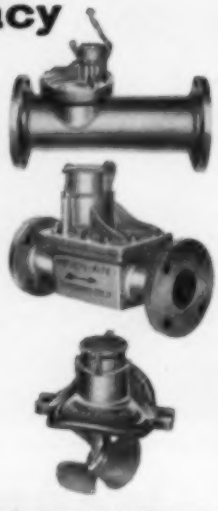
No other machine can dig so close to pipes, water lines and curbing *without damage*...and do it so fast!

WARNER & SWASEY
CONSTRUCTION EQUIPMENT DIVISION
Cleveland 3, Ohio

Gradall®



vary in mounting position but never in accuracy



Even *inclined*, Measure-Rite propeller meters will accurately register water flow. This major design advantage is just one of many Measure-Rite refinements. Here's more:

- **Free-flow design** — Puts the assembly forward, full centered in chamber to assure low loss of head.
- **High accuracy over wide range** — Measure-Rite meters register within ± 2% when used within recommended range.
- Adaptable to recording and chemical feed control.

All Measure-Rite meters can be equipped with Badger Read-o-Matic for convenient station-by-station meter reading. Write for full details on complete line, or see your Badger representative.

MEASURE RITE, INCORPORATED

Subsidiary of Badger Meter Mfg. Company

4545 W. Brown Deer Rd. • Milwaukee 23, Wis.

Compact Wheel Tractor Makes Maintenance Jobs Easy

172. Rugged and powerful yet exceedingly low in cost, the Speedex Model S23 tractor with 9 hp engine will work for you all year around on park and yard maintenance chores. Attachments include gang and rotary mowers, cutter bar, front and rear blades. Check advantages of this versatile machine by writing Speedex Tractor Co., 367 N. Freedom St., Ravena, Ohio, or check the card.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass.

Information on Boring Machines

345. General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Earthworm Boring Machine, Inc., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included.

Slurry-Seal Spreader For Surface Sealing

370. The new slurry-seal method with the Tarco spreader gives a thin, even application of asphalt-sand-water slurry and fills and seals cracks and makes skid-proof surfaces. Check the reply card or write Tarrant Mfg. Co., 28 Jumel Place, Saratoga Springs, N. Y., for complete details.

For Fast Hole-Digging

394. . . . discard old fashioned ideas and tools and look into this new, highly maneuverable hydraulic digger that paces utility, guard rail and similar earth boring operations with amazing speed and economy. Hole diameters to 24", depths to 75 feet. New bulletin D-6 tells how good it is—and why. Address Mobile Drilling, Inc., 960 N. Pennsylvania St., Indianapolis 4, Ind., or use our card.

Catalog on Transits, Levels and Surveying Equipment

435. Warren-Knight field equipment for surveying is covered in a 26-page well illustrated catalog. Specifications, models and prices are included. Check the reply card or write Warren-Knight, 136 North 12th St., Philadelphia.

The Trucks You Need for Every Public Works Job

461. Extra life and operating economies are built-in features of every Ford truck model. There's a chassis size and engine for each of your needs, from light utility work to heavy-duty construction jobs. Get latest literature from Ford Motor Co., Truck Div., Dearborn, Mich., by checking the reply card.

Ultra-Clean Sweeping For Streets, Yards and Airports

499. A new approach to extra-clean sweeping is described in a 4-page illustrated Bulletin (No. 85.55) issued by the G. H. Tennant Co., 735 N. Lilac Drive, Minneapolis 22, Minn. Described is a 7'4" path sweeper that eliminates the use of water for dust control. Check the reply card.

A Completely Hydraulic Ladder

610. This completely hydraulic ladder is described in a new catalog published by J. H. Holan Corp., 4100 West 150th St., Cleveland 11, Ohio. Detailed drawing of the pedestals, throttle control and ladder construction are included.

Sweepers Handle A Variety of Jobs In Every Season

684. Mechanical drive one-way and pull type 2-way sweepers and hydraulic 2-way sweepers that are tractor-mounted or loader-mounted are fully covered in literature from M-B Corp., 1611 Wisconsin Ave., New Holstein, Wisc. Jobs like cleaning dust, dirt and snow from streets and highways and sweeping park lawns are a few of the sweepers applications. Check the reply card.

A fine point
in Badger
meter accuracy:
Old-style longer slot weakens chamber halves, with possibility of distortion.
Exclusive dovetail thrust roller insert

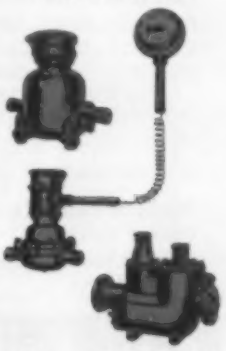
cuts wear and noise at the water level

It's standard on all Badger Disc meters. Dovetail thrust roller insert fits vertically into the thrust roller slot to form a smooth track on which the roller rides countless times — quietly without wear. With the slot 77% shorter, original strength is retained and possible distortion in this area is eliminated.

Accurate registration is constant because the nutating disc never shifts position. After many years of service an inexpensive insert can be replaced if necessary (instead of a possible chamber replacement).

The dovetail thrust roller insert is just one of many refinements to emerge from Badger's concentration on *meter* research and development. For further details, see your Badger representative. Ask him, too, about the new Read-o-Matic outdoor meter-register. Proof that answers for better water metering come first from Badger.

BADGER'S BIG PARADE OF PRODUCTS FOR BETTER WATER METERING



Badger Water Meters

BADGER METER MFG. CO. • 4545 W. Brown Deer Rd., Milwaukee 23, Wisconsin • *Offices in Principal Cities*

To order these helpful booklets check the reply card opposite page 34.

Make more money by handling more trenching jobs... *Faster...* with an ARPS TRENCH HOG!

tractor mounted

★ *Economy* . . . priced well below independent-drive machines. Operation and maintenance costs are rock-bottom low.

★ *Speed* . . . up to 800' hourly dependent upon soil conditions.

★ *Big Capacity* . . . depth capacities of 3½', 5½', and 7'; trench widths of 6" to 20".

★ *Choice of Cutters* . . . slicer for normal, wet, or sticky soils; chisel for hard, rocky soils; super-service for frozen ground.

★ *Accurate* . . . Precise depth control obtained by power pump boom control valve.

★ *Independent Wheel Control* . . . for each tractor drive wheel insures straight line digging or curve trenching.

★ *Optional Features* . . . include standard and tiling crumbers, one-side dirt delivery. Front-mounted Dual-Action Dozer available for fast backfilling.

Write today for literature and prices. Dept. PW

ARPS CORPORATION New Holstein, Wis.

TRENCHERS • HALF TRACKS • BULLDOZERS • UTILITY BLADES

Now... *a 6 minute splice* for Rubber Waterstop

To splice Gates new Kwik-Seal Rubber Waterstop, all you need is a small splicing kit and simple clamping device. This eliminates the need for a field vulcanizer, molded parts, a power supply or heat.

The Gates Kwik-Seal splice is chemically bonded. The strength of the bond often exceeds the strength even of the rubber—far stronger than government requirements. *You make this strong, permanent splice in just 6 minutes—5 times faster than with former methods!*

As a result, this new Gates splicing method cuts your labor costs and speeds the job.

WRITE FOR CATALOG and splicing demonstration.

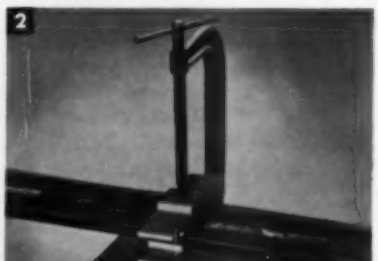
The Gates Rubber Co. Sales Div., Inc.
Denver 17, Colorado

Gates Rubber of Canada Ltd.
Brantford, Ontario

TPA 977

SEE OUR CATALOG IN SWEET'S

Apply Kwik-Kem bonding chemical to prepared surface.



Clamp Waterstop firmly for 5 to 6 minutes... and it's spliced.

Gates

Gates Kwik-Seal Waterstop

Complete Line of Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConnaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Vacuum Cleaner and Leaf Collector For Cleaner Streets

595. A unit is now available that can be mounted on a right-hand drive jeep or a pick-up truck for picking up gutter trash and leaves. Complete specifications, capacity, operation and installation procedures are covered in a bulletin available from Tarrant Mfg. Co., Saratoga Springs, N. Y.

Transit Cranes for Bridge and Highway Building

691. Transit cranes that can lift 33,000 lbs. at 20-ft. radius, and 13,000 lbs. at 40-ft. radius with 60-ft. boom and outriggers set are described in literature from Bucyrus-Erie Co., South Milwaukee, Wisconsin. Also featured are load control, folding boom and boom lengths.

CONSTRUCTION EQUIPMENT AND MATERIALS

To Keep You Up-to-Date . . .

23. On tractor loaders, motor graders and tractor shovels, Allis-Chalmers keeps bringing out new literature that is well worth your while. Ask them for it, specifying where your interest lies. Write Allis-Chalmers Mfg. Co., Tractor Group, Box 512, Milwaukee 1, Wis. or circle our card.

Black Top Maintenance and Construction Equipment Catalog

114. A highly informative catalog covering the field of road maintenance and construction equipment is available from Littleford Bros., Inc., 457 E. Pearl St., Cincinnati 2, Ohio. Check the reply card.

Two New Tractor Shovels

117. To deliver maximum production combined with fast, economical operation two new models have been announced. Each has three interchangeable buckets and the famous Trojan Safety Curve Lift Arms. Ask for specification bulletins from The Yale & Towne Mfg. Co., Trojan Div., Batavia, N. Y., or circle their number on the card.

The Principles of Compaction by Vibration

388. Compaction specifications that can't be met with ordinary compactors are no problem to the new Essick vibrating rollers. Complete descriptive literature explaining the principles of compaction by vibration and the Essick vibrating roller is available from Essick Mfg. Co., 1950 Sante Fe Ave., Los Angeles, Calif.

Power Tamper for Granular Soil and Bituminous Surfacing Work

342. The Kelley Power Tamper is a self-propelled unit that is equivalent to a 10-ton roller for backfilling, road widening jobs and compacting around culverts and pipeline trenches. For complete specifications write Kelley Machine Div, Wiesner-Rapp Co., Inc., 285 Chicago St., Buffalo 4, N. Y., or check the reply card.

Easier Road Widening and Trench Filling

451. Efficient Power-Pack Conveyor equipment and methods for filling trenches and doing curb, shoulder and maintenance work are described in a handsome booklet. Find out how these machines can lighten your labors and lower your costs. Write Power-Pack Conveyor Co., 836 E. 140th St., Cleveland 10, Ohio.

Gradall Earth Moving and Construction Machine

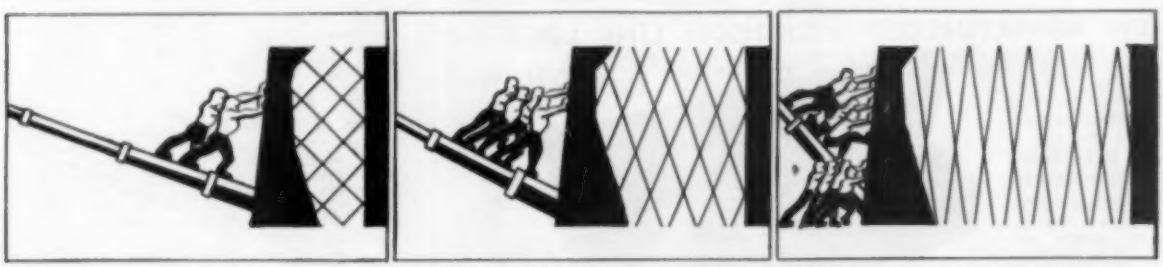
496. The multi-purpose Gradall is described in catalog avilable from the Gradall and Hopto Divisions, The Warner & Swasey Co., Cleveland 3, Ohio. Check the reply card for description of machine, applications and specifications.

15 Hydro E-Z Packs improve operating efficiency 33%

A. J. PASQUALETTI,
President,
Arizona Service Co.

"E-Z Packs reduce dump trips per truck from 5 to 3 daily"–

In Phoenix, Arizona, Arizona Service Co. bought its first 20 cu. yd. Hydro E-Z Pack in 1957 . . . saw that the unit was outperforming its 15 yd. trucks by 33%, and bought 14 more. Ten are 24 yd. units. A. J. Pasqualetti, President, says the big E-Z Packs reduce dump trips from 5 to only 3 daily, saving at least 1½ hours daily travel time per unit. City inspectors compliment the clean pickup with no trash windblown or fluid leaking from the watertight bodies. And the owners like the efficiency, economy and easy maintenance of their Hydro E-Z Packs! See your E-Z Pack distributor or write us for a free copy of an informative booklet, "The Big Squeeze."



Telescopic cylinder size increases as load increases. Cycle starts with 5½" section's 32,450 lb. compaction force.

More force is applied by larger cylinder sections as load gets larger, crushing all types of rubbish, garbage completely.

76,600 lb. squeeze applied by big 8½" cylinder section toward end of cycle overcomes cushioning effect, bales load.

Hydro E-Z PACK

HYDRO E-Z PACK®

HYDRO E-Z PACK DIVISION OF HERCULES GALION PRODUCTS, INC., GALION, OHIO U. S. A.

To order these helpful booklets check the reply card opposite page 34.

Self-Propelled Ditching Machines

438. Information on a self-propelled one man operated ditching machine, model 324 T, model W-2 and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 324 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Model W-2 Ditcher digs from 2" wide up to 4" down to a depth of 30". Full data on these ditchers available by checking the reply card.

Levels Sidewalks and Curbs Quickly and Easily

518. How the Mud-Jack Method for raising concrete curb, gutter, walks and streets solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a bulletin by Koehring Company, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the reply card.

Specification Sheets on John Deere Tractors and Equipment

588. Information and specifications on the John Deere crawler and wheel-type industrial tractors and working equipment. Deere & Co., Industrial Division, Moline, Ill. Check the reply card. State type of tractor and equipment.

The Tractors that Put the Utility into Utility Tractors

618. Low profile, high clearance, and a new Shuttle clutch, power steering are a few features. For the full story write Allis-Chalmers Mfg. Co., Milwaukee 1, Wis., for Utility Tractors literature, or circle our card-number.

Portable Water Coolers Used on Maintenance and Construction Work

651. Igloo cans and coolers are permalined and range in capacity from 2 to 15 gals. Models and sizes are covered in bulletin available from Igloo Corp., P. O. Box 8227, Memphis 4, Tenn., or by checking the reply card.

Pre-Assembled Dowel Units For Highway and Airport Construction

527. Laclede dowel assemblies for expansion, contraction and construction joints are precision welded into one unit and are maintained in rigid alinement. For full details write Laclede Steel Co., St. Louis, Mo., or check the reply card today.

Data on Portable and Stationary Air Compressors and Accessories

682. Covered in literature available from Gordon Smith & Co., Inc., Bowling Green, Ky., are the basic designs of portable air compressors, models, operating features and specifications. Check the reply card.

•

WEED AND DUST CONTROL

Calcium Chloride For Road Construction and Maintenance

41. Calcium chloride for concrete road construction, for maintenance of unpaved roads and for the control of ice are covered in literature from The Dow Chemical Co., Midland, Mich. Check the reply card.

How to Cut Weed Control Costs

308. Information on a weed killer that can save hundreds of man-hours of clearing and cutting is available from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio. Whether you want to control weeds or brush or both, without damage to crops or ornamentals, get this literature today by checking the reply card.

•

STREET LIGHTING AND TRAFFIC CONTROL

Steel and Aluminum Lighting Standards

34. Street and highway lighting standards, floodlighting standards, traffic signal standards and arms, strain poles, brackets and mast arms and accessories are some of the units described in catalog from Kerrigan Iron Works Company, P. O. Box 479, Nashville 2, Tenn.

Finest Line of Markers for Fine Line Marking

165. Complete information on truck mounted highway markers, self-propelled line markers, all purpose line markers, and hand-propelled line markers is available from the M-B Corporation, New Holstein, Wis. Photographs and specifications of each type of line marker are included. For more, check the handy reply card.

Complete Catalog on Traffic Control Equipment

240. All types of controllers, PR system of coordinated traffic control, vehicle detectors, timers, vehicle counters and radar speed meters are covered in catalog available from Automatic Signal Div., Eastern Industries Inc., Norwalk, Conn. Check the reply card.

Manual on All Types of Traffic Signs

279. This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flex Co., Inc., 1824 East Second St., Wichita 14, Kans.

Sign Catalog Has Latest Specifications

417. Detailed information on all classifications of standard signs for traffic control, street identification and other purposes together with a complete line of accessories is presented in a convenient Sign Manual by Lyle Signs, Inc., 2731 University Ave., S. E., Minneapolis 14, Minn. Get Catalog B-55 for most recent data and specifications on U. S. Standard signs.

DEPENDABLE

The Tarco "Litter-Shark" is a full vacuum **quality-built,** push-type litter collector.

Vital metal parts of the "Litter-Shark" are **guaranteed** for one full year. The all steel suction impeller will even **handle tin cans.** You'll never have to replace a suction housing. The heavy, zippered canvas **dust-control bag is patented.**

The rugged, quality-built "Litter-Shark" assures **long life, trouble-free operation.** It's **dependable.**

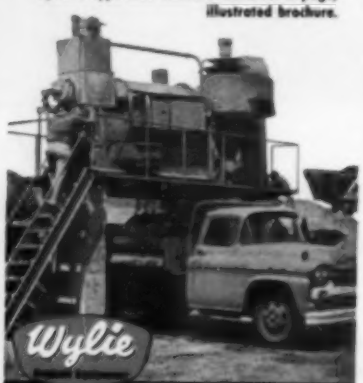
Ask for literature. Modernize your litter collection work.

TARRANT MFG. CO.

28 Jumel Place, Saratoga Springs, N.Y.

SAVE LABOR
with
ROADMASTER
Hot Asphalt Plant
It's Completely Automatic

The only self-contained asphalt plant, with fully automatic aggregate batching and asphalt metering, specifically designed for municipalities. Available as stationary or mobile unit. Costs no more than manually operated plants. SAVES THE LABOR OF AT LEAST ONE MAN. Rotary dryer with forced draft. Twin-shaft pugmill with enclosed oil-bath gear box. Enclosed bucket elevator and reciprocating feeder. 400 gallon asphalt tank. Cyclone-type dust collector. Send for 8 page, illustrated brochure.



WYLIE MANUFACTURING CO., INC.
P. O. BOX 7086 • OKLAHOMA CITY 12, OKLA.

NEW MINIATURIZED WILKINSON LINE LOCATOR

MODEL W-3

Radically new, powerful, transistorized locating instrument weighs only 4 lbs. and is ¼ as large as old type pipe locators.

Telescoping aluminum handle; 2 oz. single ear set; all in carrying case.

Write today for brochure and instruction manual.

WILKINSON PRODUCTS COMPANY
3987 Chevy Chase Dr., Pasadena 3, Calif. **SYlvan 0-4314**

To order these helpful booklets check the reply card opposite page 34.

REFUSE COLLECTION AND DISPOSAL

Make Molehills out of Your Refuse Mountains

94. New and better ways of refuse and garbage collection and handling are described in newest literature on collection systems employing giant containers, bodies and trailers that speed your work, cut costs, improve sanitation. Adaptable to small cities as well as large. Write Dempster Brothers, Dept. PW, Knoxville 17, Tenn., or circle the number on our card.

Versatility, Compaction Force Account For Extra Packer Capacity

139. The many advantages of this modern packer unit have been combined into a fact-filled bulletin entitled "The Big Squeeze" which is available from E-Z Pack Div., Hercules Galion Products, Inc., Galion, O.

Load-Packer 600 Points the Way to the Best in Refuse Collection

188. Bulletins W-200, W-220 and W-221 explain how the Gar Wood Load-Packer gives faster operation, bigger payload, more compaction, a larger hopper and more dependable operation. Write Gar Wood Industries, Inc., Wayne, Mich., or check the reply card for full details.

Literature Describes M-B Contain-O-Pack System

190. A 6-page catalog describing the M-b Contain-O-Pack, a complete low cost containerized refuse system for private haulers and municipalities is available from M-B Corp., New Holstein, Wisc. Check the reply card.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

Methods and Benefits of Sanitary Landfill

409. Information on Sanitary landfill methods, organization and necessary equipment with which to carry out the job is available from the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Quit Spending So Much Money

411. . . . is the general idea of new booklet on versatile International Drott equipment for specialized refuse disposal. Tells how cities and counties saved big money with proper equipment. It might help you, too. Address Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill., or check our card.

For Better Municipal House-Keeping

432. . . . you will want to know about the "Load Lugger" system of refuse collection, storing and disposal. It mechanizes a growing problem, cuts manpower requirements, speeds collections and pays its way. To get the details just write for Bulletin 457 to Load Lugger, Ingersoll Kalamazoo Div., 1810 N. Pitcher St., Kalamazoo, Mich., or circle number on card.

Complete Package Dravo Incinerator Plant

475. The Dravo incinerator includes automatic refuse and raw sewage sludge handling combustion controls, water wall furnace, ash disposal system, flue gas scrubber and everything necessary for the efficient operation of the plant with minimum personnel. Write for full information to Dravo Corp., Dravo Building, Pittsburgh 22, Pa., or check the reply card.

Modern Methods in Sanitary Landfills

699. Up-to-date data, pictures and explanation of sanitary landfill, its methods and equipment are covered in this valuable bulletin from The Oliver Corp., 19300 Euclid Ave., Cleveland 17, O. Check the reply card for information on satisfactory garbage and refuse disposal methods.

LONGER WHEELBASE...

It still turns tighter!

There's no sacrificing stability for short turning radius with an Allis-Chalmers utility tractor! They *have* rock-solid stability because *longer* wheelbase keeps their weight spread out. You get more feet on the ground.

Power-shift rear wheels and adjustable front axles widen out for greater stability on slopes . . . or narrow up for better maneuverability in tight quarters.

Get all the facts on Allis-Chalmers' practical engineering by mailing the coupon below. Remember, it doesn't cost to find out!

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Utility tractors from 31 to 63 engine horsepower with companion equipment to match your needs!

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Please send me more information about Allis-Chalmers utility tractors with ☐ backhoe ☐ loader ☐ fork lift

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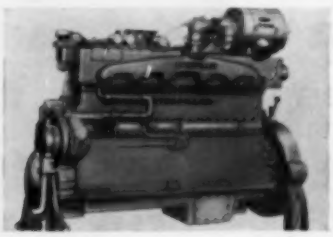
engine power
BY CATERPILLAR

CAT NATURAL GAS ENGINES...
lowest operating cost, highest output for size of any natural gas engine on the market

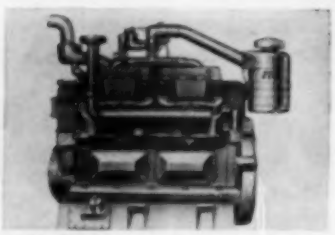
Built on basic diesel blocks using standard diesel engine parts wherever possible, Cat Natural Gas Engines give you the operating economies and long life for which Cat Diesels are famous. A Cat Natural Gas Engine has been operating 24 hours a day, seven days a week, at the Greater Peoria Sanitary District since 1954. Service takes six hours a month to change oil and filters.

Over-all operating economies of these engines are the lowest in the industry. A public utility company is currently generating power with these engines and selling it for 8.6 mills per KW/hr. Whereas, electric utility rates in most areas run one to two cents a KW/hr.

Your nearby Caterpillar Dealer can show you in detail why Cat Natural Gas Engines are your best buy for such applications as sewage disposal plants, gas separation plants, and prime or standby electric power. Choose the 7.5 to 1 or 10.5 to 1 compression ratio in a 6, 8, or 12 cylinder engine for continuous power requirements, without derating, from 210 to 470 HP. Call him now.

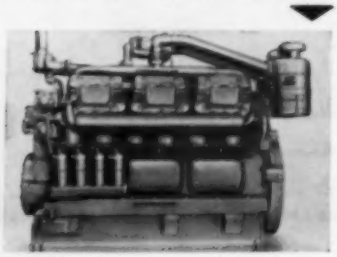


CAT G342
10.5 to 1—235 HP @ 1300 RPM—125 KW
7.5 to 1 —210 HP @ 1300 RPM—100 KW



CAT G375
10.5 to 1—310 HP @ 1300 RPM—175 KW
7.5 to 1 —275 HP @ 1300 RPM—160 KW

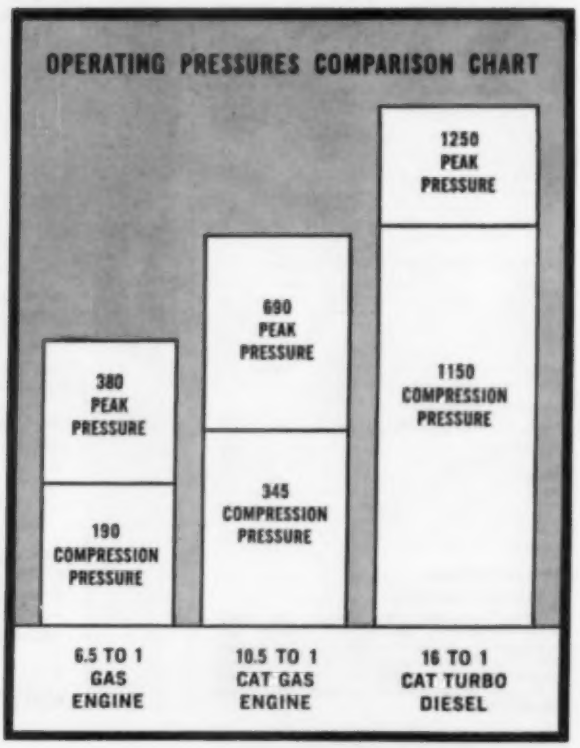
CAT G397
10.5 to 1—470 HP @ 1300 RPM—275 KW
7.5 to 1 —415 HP @ 1300 RPM—250 KW

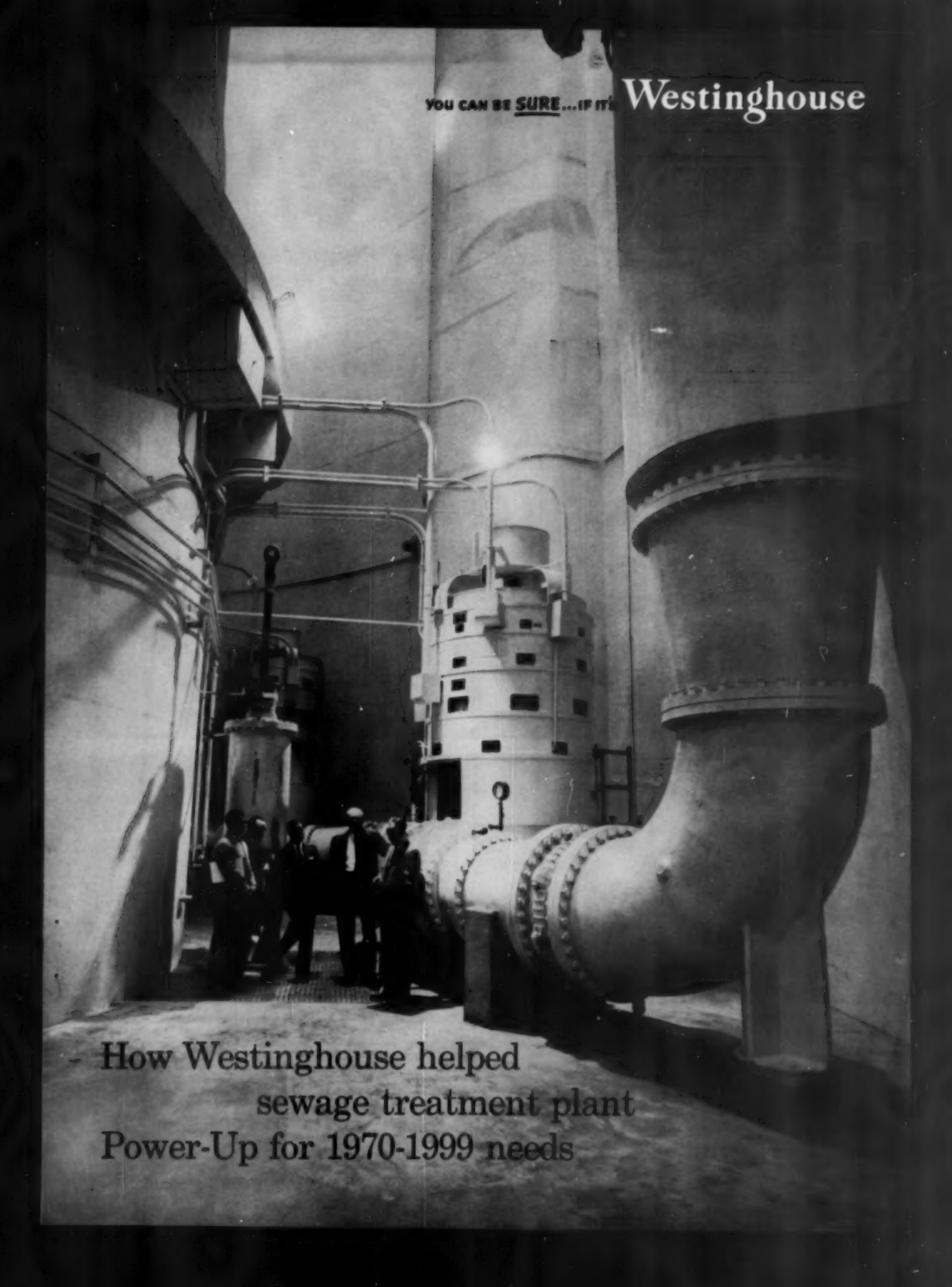


CATERPILLAR
Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A.

Caterpillar operating pressures are about four times that of competitive gas engines. To derate the Cat Engine to 65 per cent is unnecessary since the engine is already operating well within the peak pressure load for which the engine is designed. Other make engines designed explicitly for gas service, and of corresponding lighter construction, find it's necessary to derate under continuous operation to provide reasonable engine life.



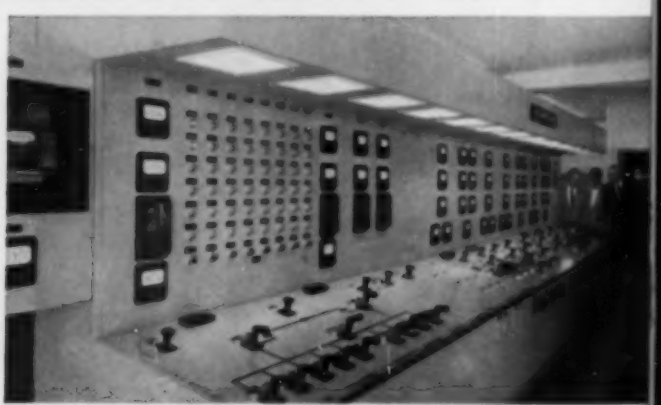

YOU CAN BE SURE...IF IT'S Westinghouse
How Westinghouse helped
sewage treatment plant
Power-Up for 1970-1999 needs

Front Cover: View in dry well of main sewage pump driven by Westinghouse 450/1250-hp 2-speed vertical synchronous motor in foreground. Constant-speed 800-hp motor in background drives its pump through a variable-speed magnetic coupling. Dry well is illuminated with Westinghouse VEK-16 floodlighting. Discussing installation are: A. B. Janaszek, Westinghouse Sales Engineer; M. B. Trimble, Westinghouse Construction Engineer; N. J. Grady, Devlin & Ernst, Electrical Contractors; J. F. Laboon, Executive Director and Chief Engineer, Allegheny County Sanitary Authority; A. A. Thomas, Engineer for Operations, Metcalf & Eddy, Consulting Engineers.

J. F. Laboon, Executive Director and Chief Engineer of Allegheny County Sanitary Authority, shown beside system flow panel of the $100 million trunk sewer and treatment plant project which serves 70 separate communities. The mimic diagram depicts flow conditions throughout a 69-mile network of tunneled interception sewers. The plant and its operation incorporate the process of concentrating undigested sludge for incineration.

J-94134-2

Examining sewage treatment system plans in the director's office are N. J. Grady, M. B. Trimble, A. B. Janaszek, J. F. Laboon and A. A. Thomas.



Over-all view of the main duplex control board installed in the sewage pump station. This board centralizes control of the incoming power feeders, indicates alarm conditions for each main sewage pump and also provides centralized control of pump motor speeds and performance. Shown at far end of control board are A. A. Thomas, A. B. Janaszek, J. F. Laboon and N. J. Grady.

Pittsburgh Sewage Treatment Plant builds for population growth of next 40 years

Planning by the Allegheny County Sanitary Authority went far beyond today's needs to anticipate the requirements of 1970 and beyond, to the year 2000. The new Pittsburgh Sewage Treatment Plant which serves the combined populations of 70 separate communities is now capable of handling the increased demands of 1970 populations. In addition, those structures and conduits which are not readily expandable are designed for the ultimate flow demands of the year 2000.

The Westinghouse electrical distribution system specified was planned with the same anticipation of future needs. Each component was selected to perform as part of the completely coordinated system. The entire system is capable of ready expansion to meet the increased power requirements of the future operating load of the plant.

Westinghouse electrical equipment supplied to Power-Up this 150-mgd sewage treatment project (max. rate, 300 mgd) includes:

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- Main pump control board.
- Three main sewage pump motors (vertical, synchronous), 1250/450 hp, two speed, two frame.
- Two main sewage pump motors (vertical, synchronous), 800 hp, 400 rpm.
- Two major assemblies of high-voltage fused starters and metal-clad switchgear.
- Five indoor dry-type power centers (150 to 3000 kva).
- Seventeen motor control centers as well as panelboards, dry-type transformers and standard controls.
- Westinghouse Life-Line® motors and gear drives which are utilized on pump, conveyor and auxiliary drives.

(contd.)

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J-04134-3

General view of outdoor substation at Pittsburgh Sewage Treatment Plant. Shown is Westinghouse metal-clad switchgear used for incoming line, bus-tie and distribution service, as well as one of the 5000-kva oil-insulated power transformers at the station. Also shown are Westinghouse disconnect switches, grounding resistors and outdoor substation structure. M. G. Grasha, Plant Electrical Engineer, discusses installation with M. B. Trimble.

A. A. Thomas, J. F. Laboon, N. J. Grady and A. B. Janaszek shown in main control room with line-up of Westinghouse Ampgard® fuse starters for control of the main sewage pumping motors. Metal-clad switchgear in the middle of the assembly provides incoming line protection for each starter group.

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M. B. Trimble and M. G. Grasha inspect electrical equipment in administration building basement. At right is rear of motor control center close-coupled to 150-kva dry-type power center transformer; at left is a 75-kva Type DT-3 dry-type transformer feeding a Westinghouse NLAB lighting panelboard.

General view of main pump station looking from the bottom of the dry well up to the main operating floor level 120 feet above.

Sewage plant builds for next 40 years (contd.)

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CONSULTING ENGINEERS: Metcalf & Eddy, Boston, Mass.
CONSULTING ARCHITECTS: Celli-Flynn, McKeesport, Pa.
ELECTRICAL CONTRACTORS: Devlin & Ernst, Pittsburgh, Pa.

Over-all view of Pittsburgh Sewage Treatment Plant. In foreground are the main sedimentation tanks and the effluent channel which discharges into the Ohio River. Circular building at far right is main pump station, behind which is the incinerator building with 300-ft-high stack, a landmark of the installation.

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Commentary on Water and Sewage Treatment

HOME GROUND GARBAGE

R. S. RANKIN

Consultant, Water and Sewage Treatment

THE HOME garbage grinder has acquired an unusual status for a modern household appliance. In some communities it is required while in others it is prohibited. These conflicting positions taken by some municipal authorities seem odd, especially since in the majority of communities they take no stand one way or the other. The appliance itself is an innocent accessory. Opponents appear to come from those responsible for the sewerage system and the sewage treatment plant while the proponents appear to be those responsible for refuse disposal operations. A review of some fundamental requirements may explain some of these differing actions.

The disposal of garbage in a community is a never ending operation. For years and years, disposal has begun in the home when the housewife, following the regulations of the community, wraps it or doesn't wrap it, keeps it separate, or mixes it with other refuse. Whatever the local rules, she usually complies and then awaits the semi-weekly collector to get rid of the accumulation and start over again. Her routine, once established, cannot easily be changed. It is no wonder then that she welcomes the opportunity, particularly in large families, to get rid of the disagreeable task by simply putting it down the sink and flushing it away to be forgotten.

The effect on refuse collection services of home garbage grinders is negligible according to a report of the American Public Works Assn. (1). Estimates indicate as much as 90% of municipal refuse must still be collected and disposed of. According to studies made by Purdue University (2), tests in a section of West Lafayette, Ind., showed that garbage was only 7.0% by volume of the refuse in that city. With present packaging practices in the markets food wastes in the home are diminishing while package wrappings are steadily increasing. Thus the overall costs of maintaining regular refuse collection services seem to be affected very little. Service complaints must also be diminishing, as well as nuisances inherent to the handling of garbage. In small residential communities completely equipped with home grinders and with few commercial establishments to produce garbage, the refuse disposal problem should be simplified. With the garbage removed, disposal of the remaining refuse should present no particular problem by either sanitary land fill or incineration.

As cities increase in size the percentage of homes

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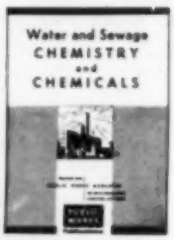

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using grinders is likely to decrease, and more restaurants, hotels and food handling concerns become dependent on prompt and efficient collection service. Therefore, except possibly for the few smaller towns able to require grinders in the majority of homes, it is unlikely that cost of services for the collection and disposal of refuse is materially reduced by the installation of home grinders.

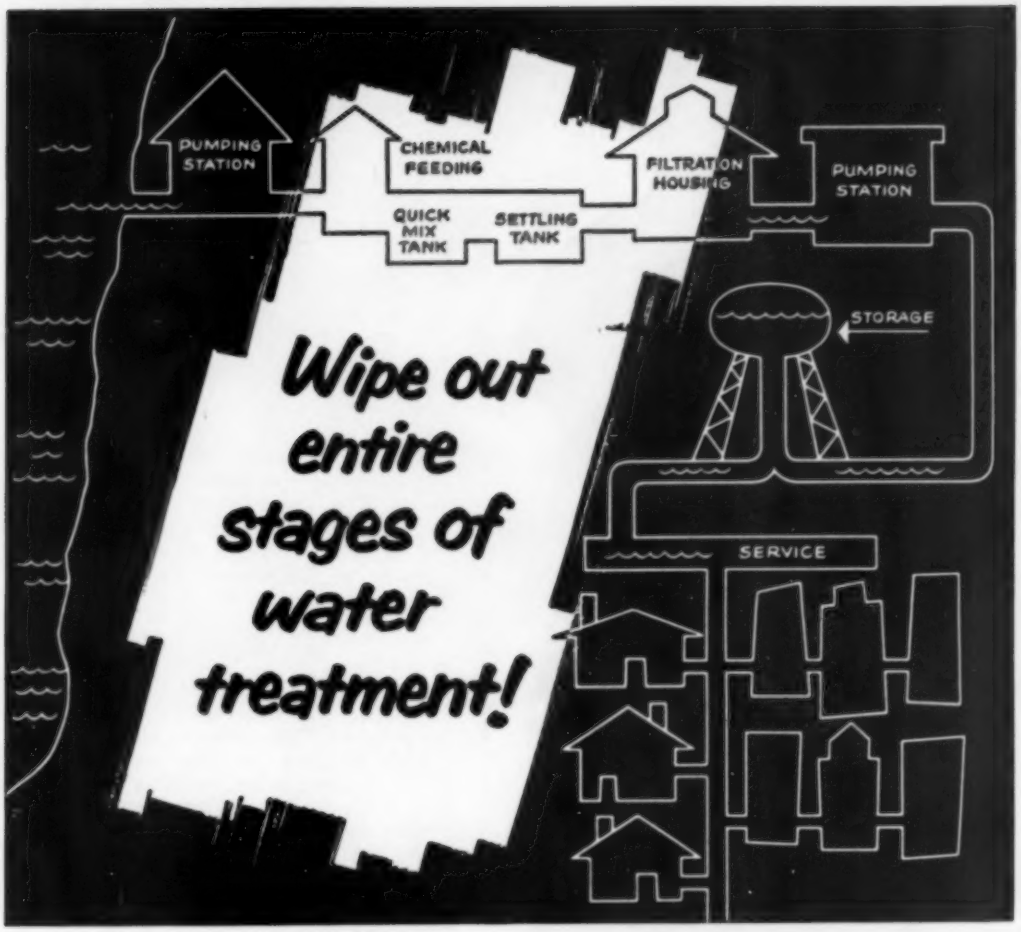
Central garbage grinding stations are of little interest to the individual home owner except that they make necessary the complete separation of garbage from all other refuse at the home, an operation which is difficult to enforce. Such stations create problems for the sewage treatment plant which are ably documented by Tolman (3), but these are not the concern of this discussion.

The important municipal operation affected by home garbage grinders is the sewerage system and the sewage treatment plant. Considering the sewerage system, every section from the house connection to the plant may or may not be affected by the home grinder. In California, one city (4) installed them in homes where the house connections were too flat and the resulting troubles discouraged further installations there. This could have been the fault of local plumbing regulations in permitting too flat slopes. However, in large cities where house connections were made, in many instances, before the turn of the century and without reliable records, no one can be certain that adequate slopes do exist.

In sewerage systems, particularly those of the separate type, built with due regard to the requirement of sufficient slope to maintain a minimum velocity of 2 ft. per sec., there is no evidence of clogging. Wraight (5) reporting on 5 years of operation of home grinders at Jasper, Ind. where the sewerage system is partly combined and partly separate, states that sludge deposits in the sewers have not been a problem. Since the practice in new communities in sewer construction, and in extensions to existing systems in older cities, is to provide separation of sanitary sewage and storm waters, the installation of home grinders in newly developed areas should produce no problem.

The ability of combined sewers in older cities to transport additional solids can be questioned, especially where their present condition cannot readily be ascertained. The recent development of internal photography illustrates what can happen in older sewers from unforeseen causes and go undetected. While these examples may be exceptional, they do cast doubt on the transporting ability of many sewers built to support loads of the horse and buggy days until they can be proved otherwise. Intercepting sewers with tributary combined sewers are usually designed to carry 3 to 4 times the dry weather flow with overflows into some watercourse for excess flows. Some material stranded in combined sewers during dry weather invariably escapes during storm flows. Unless transporting velocities exist at all times, stranded material, including any ground garbage, will likewise escape. Whether these potential conditions prevail, only the engineer familiar with the sewer system can decide and only he can evaluate them.

The major concern of those who are in a position to authorize the installation of home garbage grinders is the effect on the sewage treatment plant. When the plant has ample capacity and installations are made gradually, probably there need be little concern except to observe the progress in using up plant



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† See *Comparison Studies of Diatomite and Sand Filtration* by G. R. Bell, Journal American Water Works Association, September, 1936, or write for free reprint.

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capacity. Treatment of garbage at a sewage treatment plant creates no particular problems that have not been solved satisfactorily. In an existing plant at, or nearly up to, capacity a rapid rate of installation of home grinders could quickly create an overload. The biologic processes must carry the burden, either trickling filters or activated sludge, and the digestion system.

At Jasper, Ind., a residential town, (5) it was found that suspended solids increased from 114 mg/L before the installation of home grinders to 392 mg/L after the installation; BOD increased from 151 mg/L to 392 mg/L. The sewage flow increased from 0.407 MGD to 0.446 MGD during this interval from a population of 6200. The number of home grinders installed was approximately 1000. Fortunately, this increased load had been anticipated by providing increased capacity in the treatment plant and the effluent showed excellent average annual removals of 93.2% BOD and 97.1% suspended solids.

This experience, which is probably unique, shows that home garbage grinders when installed in the homes of practically all of the sewage contributors, do have a very material effect on the strength of sewage, the increase at Jasper in suspended solids being nearly 250%, and in BOD 150%. Since the increase in flow was negligible, only the biological and digestion processes required expansion but these were considerable. The Manual of Practice (6) states "Full use of garbage grinders in a community increases the suspended solids up to 100% with an average of above 60%, and increases the BOD up to 65% with an average of 30%. The effect on the sewage flow is negligible." These increased allowances do not equal the Jasper experience but they do confirm the need for substantial allowances in plant capacities.

Aside from the cost of the appliance to the householder, a municipality providing refuse disposal service and sewage treatment facilities will find any overall saving with the use of home grinders to be negligible; in fact, an increase might be expected. This in itself is not sufficient reason for prohibiting their installation because few cities will follow Jasper's unusual example by requiring them in 100% of the homes. Other factors such as the condition of the sewerage system and capacity of the treatment plant require valuation by competent engineering authority before any decision is made.

With over 25 years of use, obviously the home garbage grinder has joined the list of appliances designed to ease the housewife's burden and it is here to stay. Most communities now take it for granted and adjust their municipal functions accordingly. Those which do not or cannot for physical reasons permit their installation are eventually going to find some means of acceptance possibly by controlled demonstration in limited areas where its feasibility can be assessed.

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3) Ground Garbage, its effect on the sewer system and the sewage treatment plant. S. I. Tolman, *Sew. Jrnl.* Vol 19, 1947, Pg 441.
4) California experience with garbage grinders. Panel discussion *Jrnl. Sew. & Ind. Wastes.* Vol 23 1951.
5) Garbage grinder experience at Jasper, Ind. Frank H. Wraight. *Jrnl. Sew. & Ind. Wastes.* Vol 28, 1956 Pg 44.
6) *Manual of Practice of Sewage Treatment Plant Design,* 1959, Pg 9.

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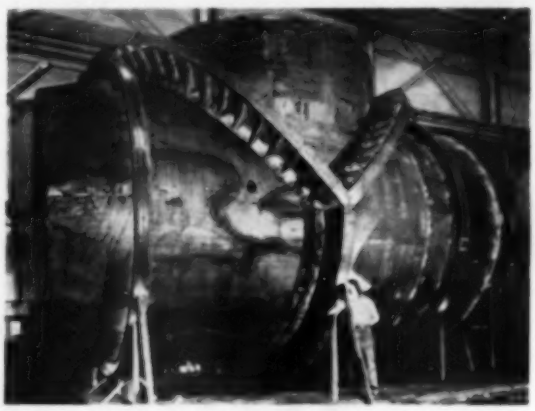
Nevada Plans Ahead For Freeways

Full description of its new 13-year construction schedule for freeways in Nevada has been announced by the State Highway Department. This schedule outlines the sequence by which all sections of Interstate 80 (U.S. 40) and Interstate 15 (U.S. 91) will become 4-lane Interstate freeways by 1975. This construction timetable was designed primarily to make long range planning easier for the communities through which the future freeways will pass. Edward L. Pine, State Highway Engineer, said that the dates in the schedule might be subject to change, but all projects will be carried out in the sequence indicated so that communities will know exactly where they stand in the program.

At present there are 18.3 miles of completed freeway on U. S. 40 through the Truckee canyon east of Reno. In all, Nevada will have a total of 533.9 miles of Interstate freeways when the program is completed. The projected cost is $218,997,000.

Steel Header Proves a Production Puzzle

FABRICATING and shaping tons of steel to produce a mammoth, 90-foot steel header pipe, and a series of smaller steel Y-connections for Detroit's new water supply system proved too complicated for regular engineering "road maps." The "pipes" being installed at the city's Waterworks Park, raw water booster pumping station, are part of the community's effort to increase the screened raw water supply to Springwells and Northeastern water treatment plants. They connect to four pumps with a capacity of 250,-



000,000 gpd, and replace existing gravity flow facilities. Because the giant header pipe (14 feet in diameter) as well as the Y branching units were to be connected at an angle, and since so many angles and curves were involved to manufacture the proper configurations in steel for accurate assembly, it was impossible to lay out the work on paper. This made it necessary to rely on mathematics for production instructions. The work was done by R. C. Mahon Co. for the city under a sub-contract from S. Morgan Smith Co., division of Allis-Chalmers.

MIT Has Computer Laboratory

A computer laboratory for civil engineering students has been established by MIT. This will be operated with one third of the computer time allocated to students, one third to the School of Industrial Management and one-third to other departments.

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D9	regular 9 inches	2 inches	3 3/16 inches	7/8 inch	28 tooth
	optional 10 1/4 inches	2 1/4 inches	3 3/8 inches	1 inch	25 tooth

HOW MUCH MORE LIFE? Variation in the length of track life occurs because components have different wear rates under various soil and job conditions. In sand, pins and bushings wear faster. In rock, shoes and links wear faster.

ON-THE-JOB TESTS confirm that the new optional track components are giving up to 40% more life than the regular parts. On many applications, you can expect even greater wear life.

CORRECT TRACK GROUP SELECTION IS IMPORTANT. It depends on job types and conditions. Let your Caterpillar Dealer analyze your track needs. He'll recommend the correct components to help you get maximum life at the most reasonable investment. Call him soon.

SERVICE TIP: **FREE!** Handy reference for ordering track options. "New Options for D9 and D8 Tractors" includes part numbers that are used to adapt to your older models. Pick up a copy at your Caterpillar Dealer's.

CATERPILLAR

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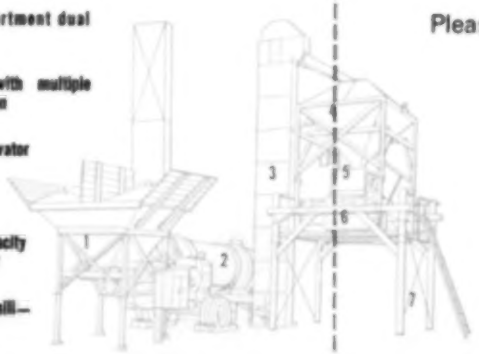
Caterpillar Tractor Co., General Offices
Peoria, Ill., U.S.A.

The rugged Littleford Asphalt Plant is built to do the job . . . gives big plant quality mixes at small plant costs. Savings of 40% on producing bituminous black top are possible because you control the mix from pugmill to pavement. No more costly delays and waiting for trucks to arrive with the hot mix . . . with the Littleford Model 121-30 you have a plant with the flexibility and versatility to produce all types of black top mixes at the lowest possible cost. Only the Littleford Plant incorporates so many new and improved designed features and offers such a complete line of auxiliary equipment for you to custom-make a plant for your operations. You receive all the profits with **A LITTLEFORD MODEL 121-30 ASPHALT PLANT.**

1. 5-ton, 2-compartment dual feeder bin
2. 30-ton dryer with multiple flight construction
3. Enclosed hot elevator
4. Storage Hopper
5. 10 cubic foot capacity Batching Hopper
6. Twin Shaft Pugmill—1000 lb. batch
7. Self-elevating platform



Please send information on the **Asphalt Plant**

name .....

address .....

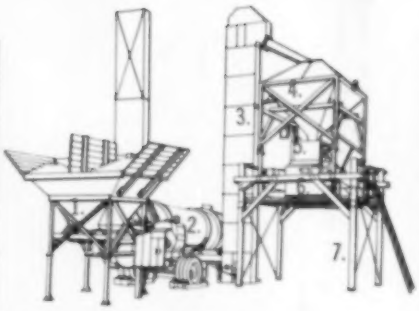
city ..... *zone* ..... *state* .....

name of firm .....

position ..... *telephone number* .....

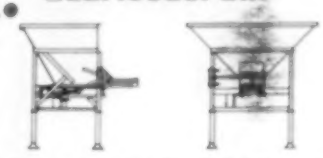
Littleford offices in Cincinnati, Ohio and Albany, New York

HERE'S A SMALL ASPHALT PLANT THAT GIVES YOU BIG PLANT RESULTS



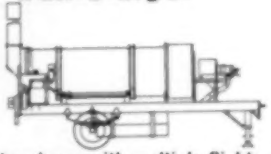
The Littleford plant incorporates many new and improved designed features that are not found on any other plant of this size. No other plant has the complete line of auxiliary equipment for you to custom-make a plant for your operations . . . you receive all the profits.

1. model 5-t-25 dual feeder bin



The 5-ton, two compartment dual feeder bin has a reciprocating feeder which feeds the aggregate in predetermined amounts directly into the dryer.

2. model 30t trail-o-dryer



The 30-ton dryer, with multiple flights construction, produces an "Even-Veil" of aggregate across the drum permitting quick drying, and heating of the aggregate. The combustion area is constructed of tough, heat resistant "Cor-Ten" steel. Fuel oil or gas burner available.

3. model he-30 hot elevator

The enclosed hot elevator delivers a continuous cascade of hot, dry aggregate from the dryer to the storage hopper at a rate up to 30 tons per hour.

4. model sh-100 storage hopper

Storage hopper holds and discharges dry aggregate into batching hopper.

5. model bh-10 batching hopper

Batching hopper has a 10 cubic foot capacity (1,000 lbs.) for measuring one batch for the pugmill. Weighing scales available if desired.

6. model pm-10 pugmill

The twin shaft pugmill equipped with adjustable paddles is positioned directly below the batching hopper. An asphalt flow meter determines the correct amount of asphalt pumped into the pugmill.

7. model ep-30 elevating platform

The self-elevating platform permits discharging of bituminous black top directly into waiting trucks.

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Proved performer on county work **BANTAM T-350**

"For county work BANTAM has no equal"

"It's where we need it when we need it"

"There's just no comparison between BANTAM and other machines"

Carrier-mounted BANTAM T-350 loads out 600 yards of material in an 8½-hour day, excavating pit-run sand and gravel.

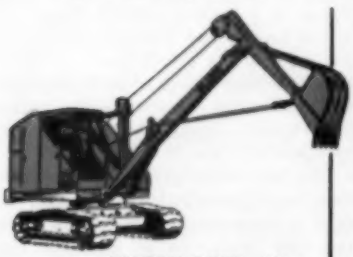
Down Mississippi way, you'll hear these comments from the men in the Pearl River County Beat (District) 4 Highway Department where their second BANTAM is speeding up road-building and other work. Pearl River chose BANTAM again because BANTAM's high speed, dependability and lowest-of-all operating cost make it the ideal machine for all types of excavating, lifting and handling jobs. County Supervisor W. E. Moody says, "For county work, BANTAM has no equal."

For excavating, loading, ditching, pile driving, culvert installations, materials handling, bridge construction or repairs, BANTAM's big-rig features and exclusive engineering advantages assure Pearl River the highest return on its BANTAM investment. BANTAM's job versatility has proved itself time and again over the 260 miles of road in the district.

Size-up BANTAM for your work!

Let us prove to you why BANTAM is the most useful, all-round rig for cities, towns and counties—the wisest investment on *every* count!

BANTAM, with clamshell bucket, prepares drainage ditch for new road. BANTAM's operational ease and big-rig speed help it to outproduce any other in its class.



BANTAM C-350—New crawler rig features an all-new undercarriage with extra stability; standard 2-speed, independent travel, and a wide choice of options. 7- and 8-ton capacity.

BANTAM CR-350—All-new self-propelled travels and works with one engine and one operator . . . offers automotive power steering, independent travel, and new, higher travel speeds. Capacity to 11 tons. 4 x 2 drive standard . . . 4 x 4 optional.

With its 11 quick-change attachments, BANTAM is ready to work anywhere. What's more, 25 optional features enable you to buy your BANTAM exactly as you want it—to fit your specific job needs.

PW-261

SCHIELD **Bantam Co.**

301 Park Street, Waverly, Iowa

WORLD'S LARGEST PRODUCER OF TRUCK CRANE-EXCAVATORS

HERE'S HOW YOU CAN GET MORE DITCH PER DOLLAR!

Photos above show the versatile Vermeer 4T POW-R-DITCHER digging a gas main trench. Manufactured for the light construction field, this small, inexpensive ditcher is excellent for water and cable lines and home foundation footings.

RUGGED, LOW COST 4T

POW-R-DITCHER

DIGS 6"-14" WIDE DOWN TO 4½' DEEP

The small powerful, ruggedly built Vermeer 4T POW-R-DITCHER is designed especially for contractors, municipalities, utilities, institutions and custom operators. Only 46" wide, the 4T is fast . . . and highly maneuverable. One-man operated, the POW-R-DITCHER is self-propelled, has two-way dirt conveyor and hydraulic track drive. Handles most ditching jobs at a fraction of the cost of more expensive ditching machinery.

IDEAL FOR LAYING GAS PIPE, WATER AND CABLE LINES AND FOR HOME FOUNDATION FOOTINGS

The 4T POW-R-DITCHER is the finest buy on the market when you want a low cost investment, low maintenance cost and high production. Capable of handling most ditching jobs, the 4T is a real workhorse!

Please send me FREE information and prices on the complete line of self-propelled Vermeer POW-R-DITCHERS.

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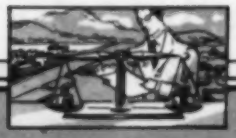

LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

City Dump as a Nuisance

Mahlstadt v. City of Indianola, 100 N. W. 2d 189, an Iowa case decided Dec. 15, 1959, was a suit against the City to abate as a nuisance the operation of a city dump for refuse and garbage.

The dump is an open type dump for refuse and garbage which is hauled there by individual residents or a trucker engaged by them. This is deposited along the edge of the existing pile of refuse which had been covered with soil previously, the combustibles in it are burned and it is then leveled and covered with soil, leaving a step down for the next dumping. A custodian or superintendent employed by the city has charge of the dump, directs the dumping and does the burning, leveling and covering.

Plaintiff and witnesses for him testified the dump was burning day and night, and when the wind was in a certain direction the smoke was heavy and thick and had a putrid odor, dogs were killed on the dump and their bodies and those of other animals were burned there, fire from the dump had burned an alfalfa field, in the spring and summer the area of the dump was infested with rats and with flies which spread to the homes in his area. He testified also the road was covered with papers, debris and garbage, which fell out of private vehicles transporting it to the dump, and such traffic was very heavy on weekends and Sunday mornings. On one occasion he saw, on the edge of the dump, materials from cesspools apparently left there by a sewage truck. Various witnesses for plaintiff gave similar testimony concerning the burning, smoke, odors, rats, flies, papers, debris and garbage in the street leading to the dump, etc. There was no evidence that the health of anyone was affected.

The open dump is the most common type in Iowa and is considerably less expensive than a sanitary land fill dump which was recommended by the regional engineer of the state health department. The chief of the Environmental Sanitation Section for Des Moines testified that many of the dumps in the cities of Iowa are much worse than the dump in Indianola.

A pest control operator is employed by the city to keep down rodents on the dump. The dump is baited for rats each month and the employees testified that they had practically if not entirely eliminated rats within a recent period.

A city councilman testified that the city was not financially able to maintain a sanitary land fill, as this would require a special machine and a skilled operator. The city had considered three other sites for a dump, and residents of each neighborhood had objected.

The city argued, among other things, that houses should not have been built so close to the city dump. The court held, however, that one's coming to a nuisance does not prevent his maintaining an action to abate it. While the fact that "a city dump is a public service essential to the health and general welfare of the community", and that its location had been apart from residential and industrial locations—the court nevertheless found that the dump, as operated, was a nuisance.

The trial court granted an injunction, but allowed the city a limited stay in its enforcement, to see what the city could do to alleviate the condition. On appeal to the Supreme Court of Iowa, however, it was held that the granting of the injunction against operating the dump went beyond the requirements of the case. Instead, the city will be allowed to operate the dump, provided it meets the following conditions:

PROVEN SERVICE... McConnaughay Weather-Proof Asphalt Emulsions have a record of satisfactory performance extending over thirty years. Their versatility and excellent reputation as quality roadbuilding materials have resulted from formulations carefully developed without regard to ionic classification.

Anionic asphalt emulsions with long and satisfactory service records are available from McConnaughay Licensees. Nonionic emulsions used over the same period of time are also available. The experience record for cationic asphalt emulsions from McConnaughay goes back over ten years. However, these emulsions are not yet considered to be in the same class of proven service as the other materials.

THE McCONNAUGHAY POSITION... Recognizing the thirty years of excellent experience with McConnaughay Asphalt Emulsions of the anionic and modified anionic types (with all kinds of aggregates), we will continue to recommend these materials as *quality products of known performance.*

We do not favor wholesale replacement of these asphalt emulsions with relatively untried binders of any variety. We do, however, *offer our experience* with asphalt emulsions of the cationic and nonionic types to highway engineers and roadbuilding agencies interested in their use.

ALL GRADES AVAILABLE... All McConnaughay Licensees are prepared to furnish all grades of asphalt emulsions, *each the best of its type.* If you are figuring on highway, street, or general paving, get in touch with your nearest McConnaughay Licensee listed at right or contact the main office.

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Now, the TELEPATH provides you with wireless communications where small size and light weight are essential!

These short range systems use a completely transistorized transmitter-receiver unit, powered by economical self-contained batteries, and weigh less than one pound.

TELEPATH systems are available for operation in either 27 mc. or 50 mc. bands. No license is required for the 27 mc. TELEPATH . . . it can be used immediately!

TELEPATH systems are a part of your wearing apparel, assuring you of more freedom and convenience of use than the old style "walkie-talkies." TELEPATH systems may be used to provide complete communication networks, either indoors or out. They also may be used directly with your present communications system, to extend its usefulness.

TELEPATH systems are unsurpassed for intelligible communications in high noise or poor visibility conditions where direct vocal or visual contact is impossible.

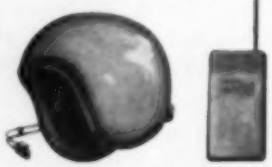
HELMET MODEL

Hard-hat with built-in radio, antenna, earphones and microphone.

BELT-CLIP MODEL

Radio unit; headset with antenna, earphones and microphone; shirt-clip controls.

OTHER MODELS



Air Force-Type for jet-engine noise.

A complete pocket-size 2-way radio.

Special Models on Request

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An adequate and effective program of eliminating rats in the dump by poison and flies in the dump and neighborhood by spraying; the erection of a fence on the side of the dump between it and the houses, to prevent the blowing to them of papers, etc. from the dump; the prohibition of the dumping of materials from cesspools, etc.; the supervision of the area to prevent the littering of streets with garbage and refuse dropped from vehicles of residents hauling the same to the dump; that dogs be not shot upon the dump and that the bodies of animals be not burned on the dump.

Road Improvements and Assessments

Fluckey v. City of Plymouth, 100 N. W. 2d 486, a Michigan case decided Jan. 4, 1960, was an action by home owners challenging special assessments levied on their property for street improvements.

Western Electric Co. erected in the City of Plymouth a distribution and repair center for products used by the Michigan Bell Telephone Co. It was found that the road in front of the plant was posted with light-weight limitations and it was felt this might seriously impede the operation of the new plant. The Company and the City then decided to improve the existing 22-foot black top road to a 48-foot reinforced concrete pavement, designed and suitable for year-round heavy truck traffic. The cost of the project was estimated at $234,000, of which the city was to pay $80,000 as its share of the expenses. Of this latter amount, 53 percent was to be borne by the properties fronting on the improvement, residential properties being assessed at $10 per front foot, side residential lots at $5 per side foot, and commercial and industrial property at $13.69 per front foot.

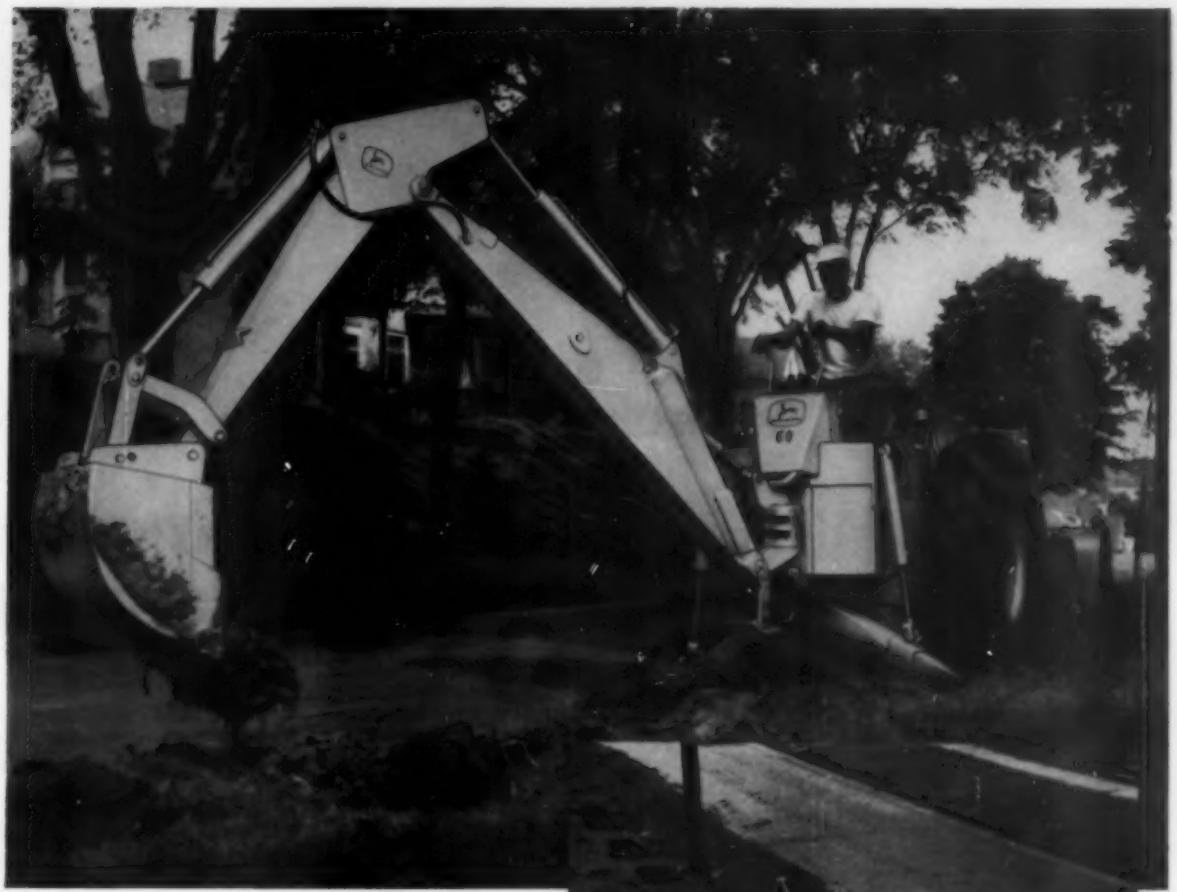
The plaintiffs claimed that they should not be required to pay these assessments, as they were not beneficial to their properties, but detrimental, since the value of their property had been depreciated by the change from a high class residential street to a street handling large volumes of motor traffic.

The court held that the plaintiffs were correct and should not be required to pay the assessments.

Those Pigeons Again

In London, England, a super-slick varnish has been reported, so slick that pigeons skid on it, sprayed on with a gun, the liquid is colorless in addition to being unbelievably slippery.

CUT TRENCHING COSTS with John Deere 2-fisted power under 2-lever control



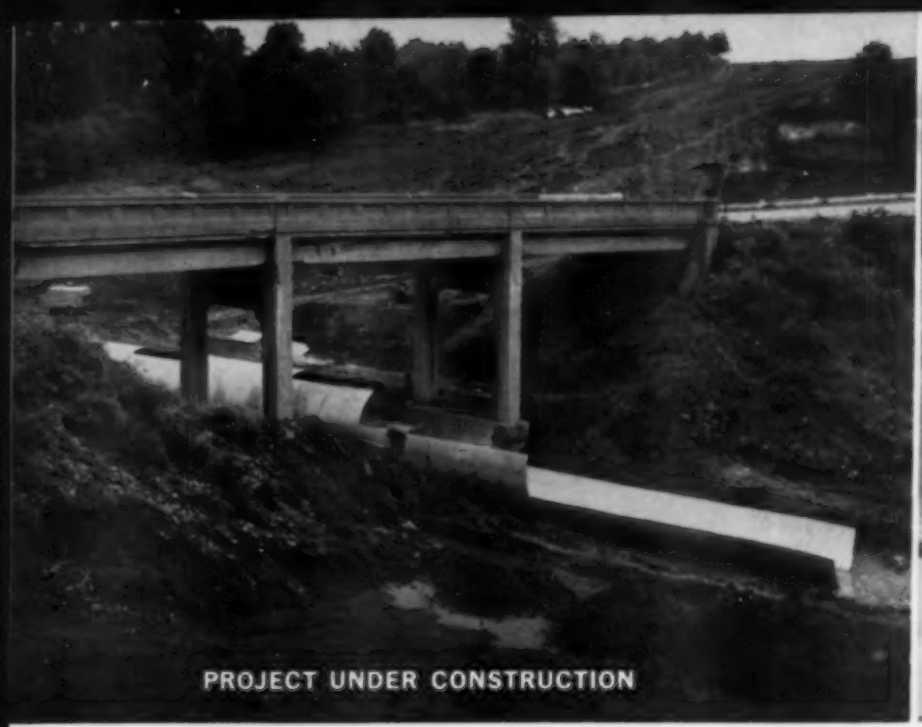
Down goes the high cost of installation when the John Deere Backhoe rolls up to the job! Here's power that takes frost and hard ground right in stride—power under responsive, efficient control of just two operating levers.

You'll find all the capacity you need in the John Deere Backhoe, too—a dump clearance of 11 feet, a ground-level reach of over 20 feet and a maximum digging depth of 13 feet, 6 inches. Boomswing of the center-mounted model is 205 degrees and a full half-circle with the five-position Model 51.

See your dealer now for a demonstration.

John Deere Industrial Division, 3300 River Drive, Moline, Illinois

JOHN DEERE *"Specialists in Low-Cost Power with a Heavyweight Punch"*



PROJECT UNDER CONSTRUCTION

PROJECT COMPLETED

DANGER-SPOT ON FAMED LINCOLN ELIMINATED WITH REPUBLIC SECTIONAL

A busy cross-country truck route . . . narrow two-lane bridge over a stream . . . blind curve . . . hills in both directions . . . all added up to a real danger-spot that was the scene of many accidents on U.S. Highway 30 west of Lisbon, Ohio.

Ohio Department of Highways' solution to the problem: straighten out the road, eliminate the bridge and curves. The bridge was replaced by a full-round Republic Sectional Plate Pipe installation. Assembly was fast and efficient—the pipe was completely engineered and fabricated at the plant, delivered ready for assembly.

Traffic over the old concrete bridge was maintained until the fill was placed around the pipe. It was then diverted to a by-pass road and the bridge was demolished and used as part of the fill.

Complete and in service, this Lincoln Highway project is a good example of modern highway engineering and safety planning—using Republic Sectional Plate Pipe to speed completion and keep costs down. For information on problem-solving drainage products to meet your requirements, contact the Republic Sectional Plate Distributor nearest you (see list at right), or mail coupon.

UNDER CONSTRUCTION

FOURTEEN FEET in diameter, 285 feet long, the sectional plate pipe was constructed of 1-gage Republic Copper Steel Plates. A 5% vertical shop elongation eliminated the need for strutting in the field. Lower half of the pipe interior was coated and paved.

COMPLETED

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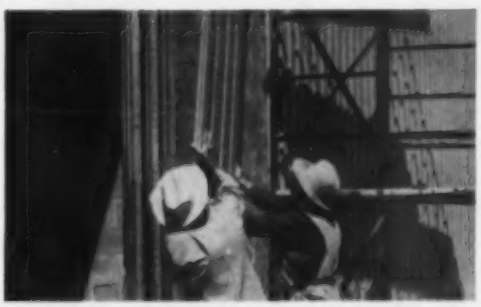
LIFT-SLAB CONSTRUCTION using columns of 10¾-inch O.D. *Republic Steel Pipe*, helped provide low-cost erection of this Cleveland, Ohio, building. Slabs were poured on ground, then gradually hoisted up the steel pipe columns by means of hydraulic screw jacks. Scaffolding and elevators were eliminated. Mail coupon for details on Republic Steel Pipe.

QUICK, TROUBLE-FREE PERFORMANCE is yours when you use *Republic Flexible Plastic Pipe* to bring in construction water . . . or drain flooded excavations. Made of tough polyethylene, it resists abrasion and the effects of acids and alkalies. In addition, it is immune to electrolytic action. Lightweight and easy to cut or join, it can be used on job after job.



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RIVER OAKS CUTS COSTS 20% WITH IDEAL CAT TEAM

Cat No. 955 Traxcavator with No. 6 Ripper rips rocky material, then loads excess in trucks.

Cat No. 112 Motor Grader ditches, cuts street to grade and levels up before resurfacing.

These two Caterpillar-built machines are on the job twelve months a year for the City of River Oaks, Fort Worth, Texas. The population numbers 10,000. Here's what Public Works Director W. F. Harrison says about their performance: "Over a period of years Caterpillar equipment has proved itself to have low operating and maintenance costs. The No. 112 and No. 955 are ideal machines for a city this size. By doing our own work with them, we not only can pick a convenient time and place to work, but also estimate a 20% saving on all jobs."

For communities the same size or somewhat larger, this suggests a money-saving use of the pair. The 75 HP No. 112 is big enough to do a good road job, yet is easy to move and maneuvers well in tight places. The 70 HP No. 955 has the capacity to handle tough material, maneuvers well in close quarters, too, and is available with quick-change attachments that multiply its usefulness.

Ask your Caterpillar Dealer for full details of the No. 112 and No. 955. Ask him for *proof*, too, of low operating and maintenance costs. He has *facts* and figures that show how their low final costs make them the most economical equipment your tax dollars can buy!

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

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STORM WATER PUMPING

FOR AN URBAN EXPRESSWAY

FRANK J. BUCKLEY
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THE DESIGN of the Prospect Expressway, Ocean Parkway and Fort Hamilton Parkway Interchange in the Borough of Brooklyn, City of New York, presented several major engineering problems not usually encountered in urban arterial highway construction.

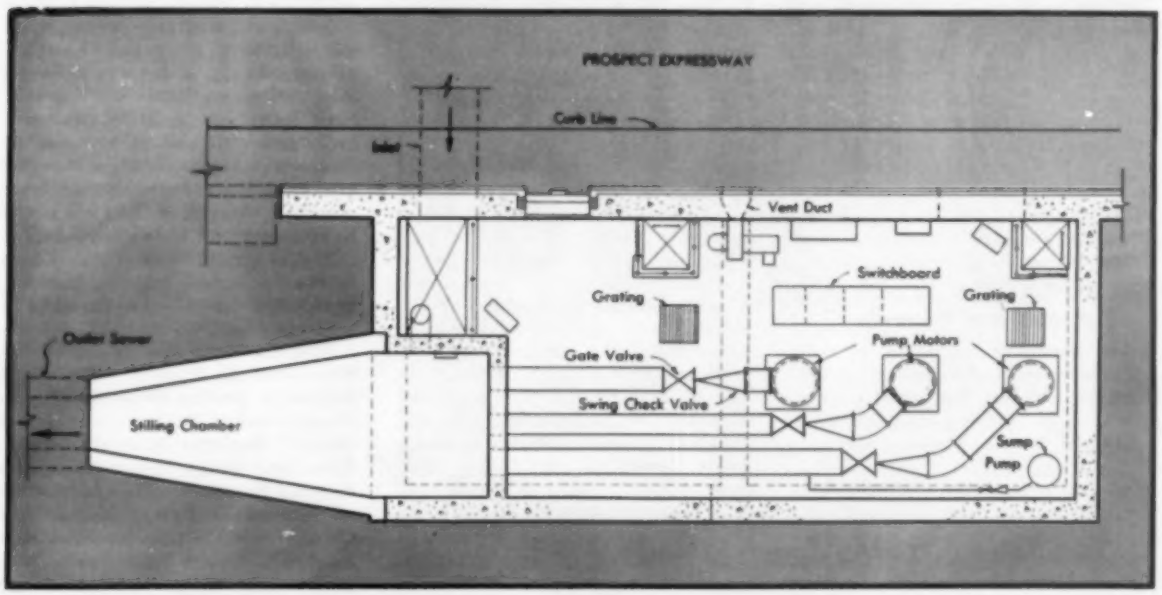
This Interchange is located in a densely populated section of the Borough and is surrounded by large, luxury-type apartment houses, a public school and a church.

In order to carry Prospect Expressway through the Ocean Parkway—Fort Hamilton Parkway intersection preliminary studies considered the use of a viaduct over the existing streets. This scheme was rejected after strong objections by the property owners and school and church authorities who contended that a viaduct structure would detract from the appearance of the residential community and depreciate property values.

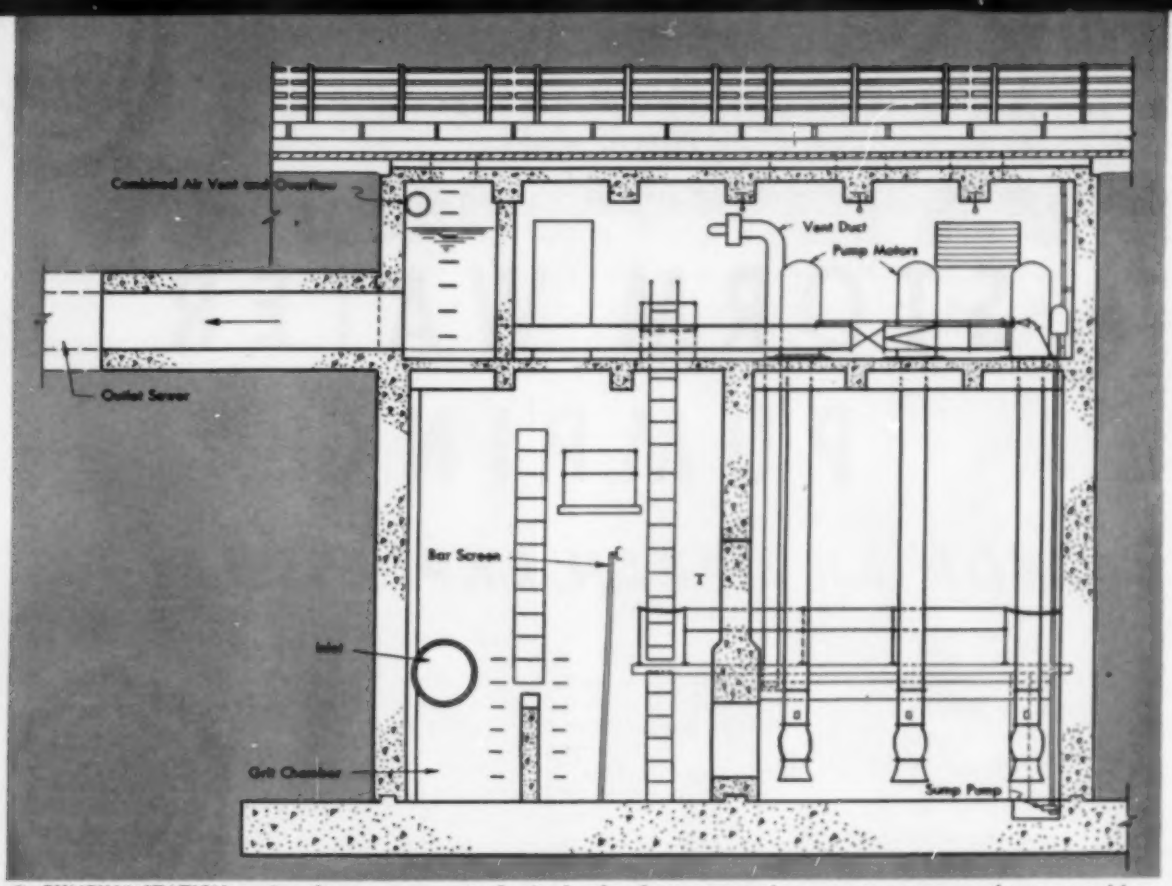
A plan was then developed with the grade of the Expressway lowered and carried through the intersection in an open cut with architecturally treated retaining walls supporting service roads at existing street elevations. This plan met with local approval.

Lowering the Expressway grade required reconstruction of a subway station and relocation of trunk sewers and water lines. In addition, since the Expressway is approximately 12 feet below the elevation of the existing storm sewers in the area, special provisions for drainage were needed. In order to overcome this problem it was decided to drain the Expressway from its lowest elevation into a wet well and to pump the storm water into the city sewer system.

The size of pumping equipment needed for this purpose was determined by computing the runoff,



● MOTOR FLOOR plan of the Prospect Expressway storm water pumping station. See also sectional view on following page.



● **PUMPING STATION** section shows arrangement of grit chamber, bar screen, main pumps, sump pump and access provisions.

using a rainfall intensity of 5.5 inches. This corresponds to a rate of rainfall of 1.75 inches per hour with a time of concentration of 8.4 minutes. These factors were based on a 15-year maximum storm. The area to be drained was computed at 6 acres and the coefficient of imperviousness was determined to be 0.90. The design rate of runoff was found to be 13,000 gallons per minute.

After the rate of runoff and lift had been determined the method of pumping was considered. It was decided that the most economical and practical arrangement of equipment was to install two pumps to provide for the required design runoff, with a third pump as a standby in case of a mechanical failure. The pump house was designed around these three pumps and the wet well.

Pumps and Controls

The pumps are of the mixed flow class specified to be capable of delivering not less than 6500 gallons per minute against a dynamic head of 35 feet. It was estimated that under normal rainfall conditions one pump only would be operated. The pumps are automatic, electrically driven and controlled by a combination of a float switch and pump selector devices arranged so that the second and third pumps would cut in when needed. In order to equalize wear on the equipment, alternate pumps would start during successive rainfalls.

The pumping station is located under a service road adjoining the Expressway. The 17′ 7½″ wide and 38′ 6″ long building is designed structurally as a cellular reinforced concrete retaining wall 38 feet high. The roof of the structure is designed to carry vehicular traffic on the service road. The wall facing the Expressway is treated architecturally to conform to the appearance of adjoining retaining walls and bridge abutment. The interior of the building is subdivided in three cells by means of an interior diaphragm wall and a concrete floor. The two lower cells serve as the wet well, the bottom of which is located 12 feet below the lowest point of the Expressway. A grit chamber is provided at the influent side of the wet well to concentrate the accumulation of sediment. This sediment is to be removed periodically by a truck-mounted crane with a catchbasin cleaning bucket operated through an opening in the roof of the structure. A 1½-in. hose bib and hose have been provided for cleaning the wet well. Wash water is removed with a manually controlled 3-in. diameter sump pump.

Main pump impellers with housings and 16-in. pump columns are located in the wet well. Pump discharge heads, direct drive vertically mounted motors, switchboard and other equipment are located on a concrete floor 24 feet above the wet well. Each discharge head is connected through a 16-in. pipe with gate and swing check valves to a stilling chamber. From there, the discharge is carried through a 36-in. monolithic concrete sewer approximately 300 feet westerly into an existing 60 in. sewer. Water-tight manhole covers, 36″ x 36″ in size, have been provided directly over each pump to permit removal of complete pump units. Access to the interior of the building has been provided through a door from the Expressway and through a manhole from the service road. The building is equipped with electric lighting, ventilation and thermostatically controlled heating.

This contract was designed by Shumavon & Buckley, Consulting Engineers for the New York State Department of Public Works under District Engineer Milton E. Goul. The Expressway is a part of the Arterial System for New York City as planned by Robert Moses, City Construction Coordinator. The Contractor is Terry Contractor Company. Construction work is being supervised by the State Department of Public Works.

TAPPING THE POTOMAC . . .

ROBERT J. McLEOD,
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MORE THAN three years ago the Washington Suburban Sanitary Commission received two reports with recommendations for the future water supply of its area from Dr. Abel Wolman, consultant, and Harry B. Shaw, WSSC Chief Engineer at that time.

Their conclusions were the same: Some new source of water had to be provided to meet the needs of an exploding population in the Washington Suburban Sanitary District, an area covering 427 square miles in two Maryland counties adjacent to the District of Columbia—Montgomery and Prince George's. In addition, the WSSC also provides water for part of nearby Howard County for a system which reaches more than half way to Baltimore.

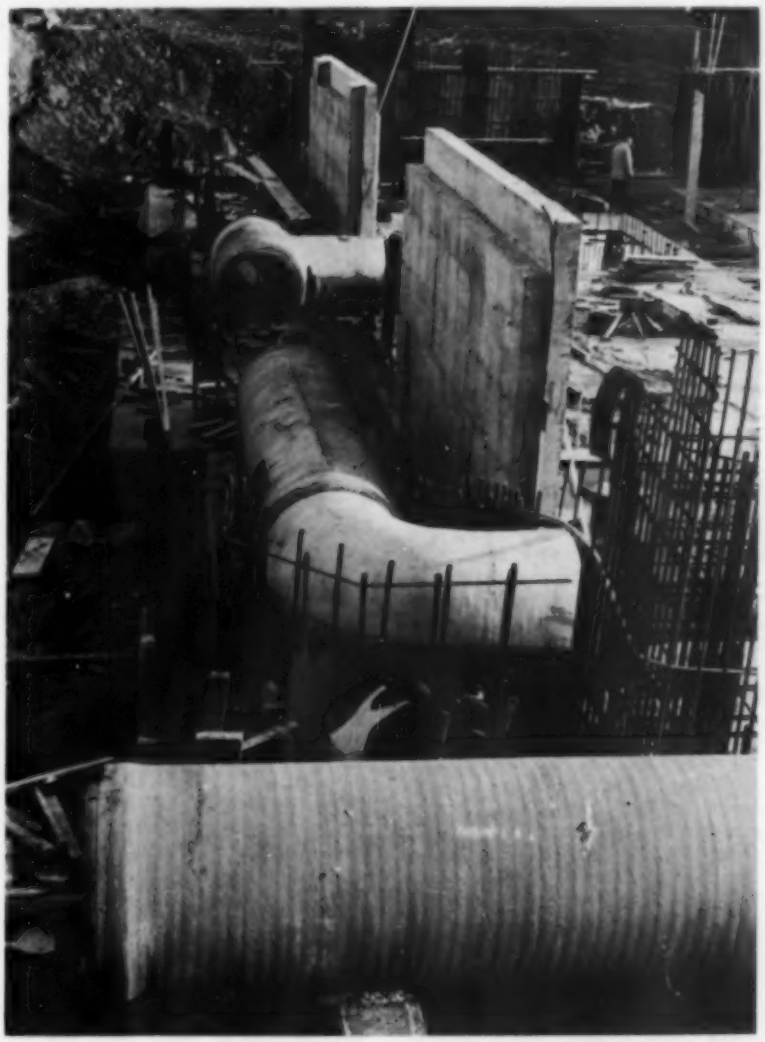
The WSSC now serves a population of about 560,000 persons, using an average of 46 million gallons of water a day; and it was recommended that the Commission provide a plant, which, together with existing facilities, would be adequate for approximately 1.2 million people.

The Commission promptly accepted the recommendations of Dr. Wolman and Mr. Shaw and in 1956, launched a four-stage, $29 million project to obtain a new supply of water from the Potomac River, with the first stage estimated to cost about $12 million.

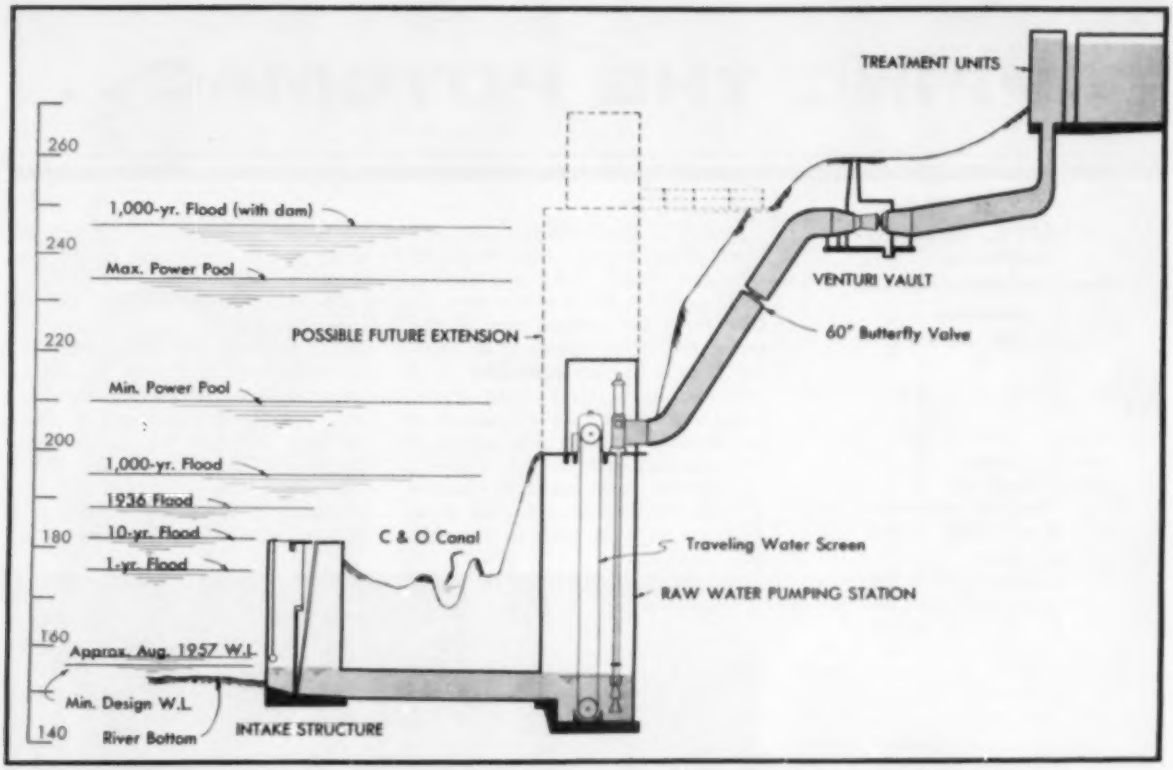
The Commission's major existing source of raw water is now the Patuxent River, which is impounded by two dams holding a total of around 14 billion gallons. The WSSC's Patuxent filtration plant can produce up to 65 million gallons of filtered water a day; and other facilities—the old, 12-mgd Burnt Mills filtration plant, several Prince George's County wells, and interconnections with the District of Columbia system—raise the total available to more than 80 mgd. This has been adequate to meet the requirements to date, but is far from sufficient to meet the water consumption demands of the future.

Design of the Potomac Filtration Plant, which is now under construction on a 35-acre tract purchased in 1958, provides for a raw water intake from the natural flow of the river. However, metropolitan engineers foresee the possibility of a reservoir on the river in the future. This was taken into consideration in selecting the site upstream from the proposed dam, so that a saving in pumping costs could be realized if a dam is constructed. The plant is being built in such a way that the intake facilities can still be used when and if the waters of the Potomac are impounded.

Potomac Filtration Plant will be constructed in four stages as needed. The first section of the plant, with a production capacity of 30 mgd, is expected to go into service this summer. Additional stages will be built as required until the ultimate capacity of 120 mgd is reached. When completed, the plant will make available to the water service area of the Sanitary District, when sup-



● **THIS view shows the 30-inch pipes that will carry water to and from the finished water pumping station. First stage installation will have capacity of 30 mgd.**



● **HYDRAULIC PROFILE of raw water pumping facilities for the Potomac River water supply development project.**

plemented by existing supplies and expected well developments, a capacity of about 200 mgd.

Design and construction of the Potomac Plant is under the supervision of Whitman, Requardt and Associates, consulting engineers of Baltimore.

So that the facility will blend into the exclusive, semi-rural country where it is located, the Potomac Plant buildings feature modern and colorful architecture which complements the landscape. Architectural design was created by Fisher, Nes, Campbell and Associates of Baltimore and offers attractive stone fronts, large glass areas and low silhouettes for such filtration plant structures as the raw water pumping station, the filtered water pumping station and the chlorine building.

"Stage 1," for which ground was broken in March, 1959, is being constructed in two contracts totaling about $6.3 million by the Malan Construction Corp. of New York. This work includes the intake structure, 60-inch raw water suction lines, traveling water screens, the raw water pumping station (60 mgd), treatment plant (30 mgd), filtered water pumping station (60 mgd), and filtered water storage reservoir (capacity: 6 million gallons).

One of the interesting tasks involved in the construction of the plant has been the crossing of the historic C & O Canal, which runs parallel to the Potomac on the east side. The raw water intake structure was located on a narrow strip of land between the river and the canal. Twin 60-inch pipelines then had to be installed under the canal to reach the raw water pumping station, where the water is raised about 130 feet up a steep bluff to the filtration plant.

Two large temporary pipes were placed in the canal to carry the flow of water downstream while the channel was diked to permit excavation and laying of the intake-to-pumping station lines. During this phase of construction—a period of several months—the C & O Canal flow has never been interrupted. When the installation is completed, the canal bed will be replaced, the temporary pipe will be taken out, the dikes will be removed, and the canal will return to its natural channel.

Dynamite has been used by the case to blast away rock, in order to place the raw water pumping station at a low enough grade to permit gravity flow of water from the intake structure. However, the station is being built high enough to be above the flood stage level of the Potomac River, and the initial installation contains pumps of sufficient capacity to meet the immediate water supply requirements of the area. Like other portions of the Potomac installation, the pumping station is designed for adaption to higher production capacities by the addition of more pumps as the filter plant is likewise expanded.

Vertical pumps are being installed on the raw water pumping station so that, in the event the Potomac is impounded, the pump motors may be adjusted to permit operation at the higher water level. The actual intake structure between the river and the canal would be inundated and abandoned in the event of impoundment. A 60-inch force main, about 800 feet in length, will carry the raw water up the rocky cliff overlooking the river to the rapid sand filtration plant.

Although not part of the plant, itself another important phase of the Potomac development is the installation of two supply lines from the plant. One consists of a 10-mile-long, 48-inch main from the new filtration facility to connect with a number of large lines in the main zone of distribution system. This line is expected to cost an estimated $2.8 million, and three contracts already

● RAW WATER pumping station will be located in this area of solid rock which is being blasted out. When completed, station will raise water up cliff in background.

● WHILE intake lines were being installed, it was necessary to carry the water in the C & O Canal past point where excavation was under way. This is how it was done.

let for a portion of it total $1,722,000. The other line is a 70,000-foot, 36-inch main, estimated to cost about $2.4 million, which will serve as a feed to the high zone in Montgomery County. This line is scheduled for construction in 1960. Rights-of-way of sufficient width have been acquired for both lines so that additional parallel mains can be installed when needed.

The goal of this huge Potomac project is to provide an adequate water supply through an integrated system fed by two major sources—the Patuxent River and the Potomac River. In addition to the $29 million Potomac River development, the Commission has scheduled about $9 million worth of major reinforcement and expansion projects in its Five-Year Program, 1959-1964.

The WSSC now owns a network of 1650 miles of water mains, 16 pumping stations and 31 storage tanks, all of which will assist in the distribution of water from the Patuxent and the Potomac throughout the Commission's bi-country area. With two rivers working for them, suburban Marylanders now can breathe easier about their water supply. Members and staff of the WSSC, who daily deal with the demands of the mushrooming population of their service area, look many years ahead with the confidence that they will be able to provide water when and where it is needed.

• • •

Costs of Laying Water Pipe

In Heston, Kans., 3,152 ft. of 10-in. cast iron pipe cost $4.50 per ft. in place; and 855 ft. of 6-in. pipe cost $2.60 per ft. In Larned, Kans., 2,315 ft. of 16-in. cast iron force main for sewage treatment cost $11 per foot in place.

Water main construction costs as reported by the Augusta, Maine, Water District for 1958 were as follows: 6-in. pipe, 2,342 ft., with 14 gate valves, average per foot $4.86, of which $2.73 represented materials, $1.02 cost of labor and $1.11 cost of equipment; 8-in. pipe, 4,649 ft., 10 valves, average per foot $4.66 of which $3.35 was materials, 63 cents cost of labor and 68 cents cost of equipment; 16-in. pipe (including 40 ft. of 12-in. and 3 valves), 1,232 ft., $14.65 per ft., of which $9.87 was materials, $1.94 was labor, $2.84 was equipment. In addition, there was an extra cost of $6,600.10 for rock excavation which brought the overall cost on this line to $19.84 per foot.

WASTE TREATMENT FOR AN ICE CREAM PLANT AND RESTAURANT

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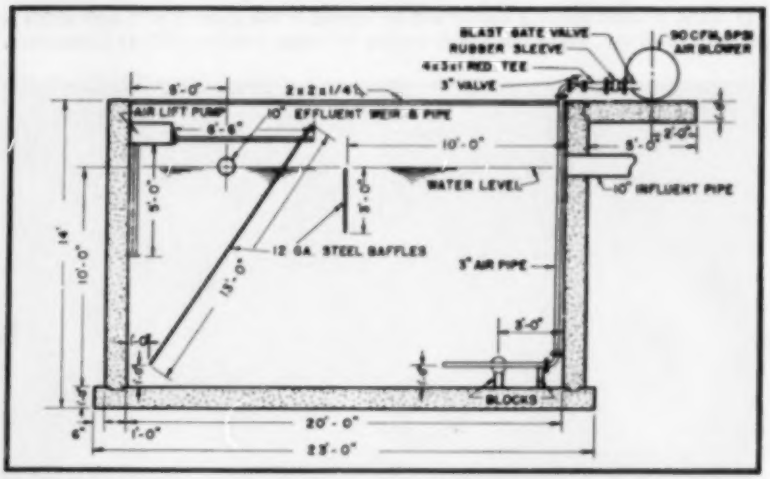
THE DEMAND for an economical waste treatment system for a combination restaurant-ice-cream plant resulted in the installation of a complete mixing activated sludge plant operating on the principle of total oxidation. While the use of activated sludge for a small installation was questioned originally, its operation over the past year has justified its use.

The A. R. Parker Company is a thriving restaurant-ice cream plant located on Route 106 in East Bridgewater, Massachusetts. During the summer months it is one of the most popular ice cream spots in this section of Massachuetts. Its popularity is enhanced by a recreation field adjacent to the plant.

The wastes from the plant consist largely of wash water from both the ice cream manufacture and the restaurant, together with domestic sewage. Prior to July, 1958, these wastes were treated in a septic tank and the effluent discharged into an open ditch, a tributary of a nearby stream. The odors and nuisance conditions created by the septic tank effluent in the open ditch caused neighbors to file a complaint with the State Health Department. After examining the situation, the State Health Department requested that A. R. Parker put in secondary treatment to eliminate the nuisance.

The initial proposal for secondary treatment consisted of subsurface sand beds following the septic tank. The cost of the treatment plant was estimated at $40,000. Because of the large quantities of fatty materials in the wastes, there was a question as to whether or not the subsurface filter beds would operate satisfactorily over a long period of time. In order to evaluate their wastes and to determine the treatment required, A. R. Parker retained Rolf Eliassen Associates.

A study was made over a two-day period in September, 1957, on the variations in waste flow and organic strength. The flow variations are shown in Table 1. It was found that the average flow on the maximum day was 460 gallons per hour with a



● **SECTION through complete mixing activated sludge plant described in this article. Blower shown at upper right was actually located inside main building of plant.**

Table 1—Rate of Waste Flow, gph

Time	Sept. 14 1957	Sept. 15 1957	Aug. 7 1958	Sept. 10 1958	7-Day Average, Feb. 14 to April 3, 1959
0700		184			
0800	303	184			303
0900	184	184	945	320	450
1000	230	454	1300+	450	700
1100	303	780	1300+	320	300
1200	378	570	460	450	450
1300	303	570	945	320	700
1400	667	454	460	450	780
1500	303	570	240	220	620
1600	230	570	240	320	620
1700	230	780		220	470
1800	454	570			
1900	184	454			
2000	184	570			
2100	137	230			
2200	184	184			
Average	285	457	605	340	580

maximum of 780 gallons per hour. The average 5-day BOD was 2.1 pounds per hour with a concentration of 460 mg/L. Since ice cream was not being made on these days, the data represented the wastes from the restaurant on the peak day of the week.

Ice Cream Manufacture

Ice cream is not produced on a major scale at A. R. Parker but rather is custom made as the demand requires. During the summer months ice cream is made 3 to 4 times a week, while in the winter it is made only once a week. It was assumed that the flow and the organic strength at the times of ice cream manufacture would not exceed the load during the peak restaurant load. The final design criteria were for 8700 gallons of waste over a 19-hour period with a maximum hourly flow of 780 gallons and for 40 pounds 5 day BOD.

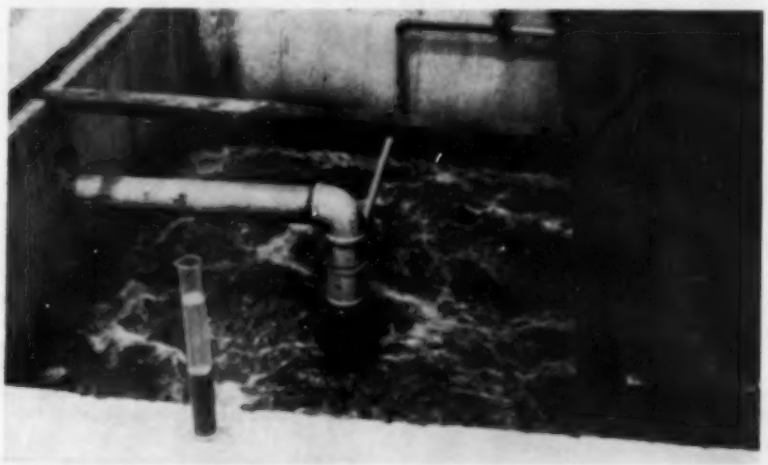
Analyses of the nature of the wastes indicated that the total oxidation type activated sludge plants would offer the most complete treatment for the lowest cost. Data were obtained on a Yeomans "Cavitator", a Chicago Pump "Rated Aeration", an Infilco "Aero-Accelator" and a design of Rolf Eliassen Associates which had been used to treat textile wastes at Dale Brook Bleachery (1). Since all of these systems were designed on the same general principles, economics was the basis of choice between the different systems. The cost of the design submitted by Rolf Eliassen Associates was found to be substantially less than the estimated costs of the other systems investigated, and the A. R. Parker Co. selected that design, using a reinforced concrete tank constructed by a local contractor.

Plant Design

The treatment plant consisted of a single tank 20 ft. by 10 ft. and 14 ft. deep with 10-ft. SWD. It was divided by a steel baffle into two compartments. The aeration compartment contained 1650 cu. ft. with a retention period of 35 hours based on average flow. The aeration device was one-inch steel pipe with 1/4-inch drilled holes. Air was supplied by a 90 cfm, 5 psi Spencer turbine blower. A steel deflection baffle was located in the middle of the tank to prevent excess turbulence in the sedimentation section.

The sedimentation section was connected to the aeration tank by 12-in. opening at the bottom of the tank, making the flow into the sedimentation section vertical to a steel pipe weir. The plant effluent was discharged into the existing sewer line through the existing septic tank and out into the open ditch. The septic tank was cleaned out so that its operation had no effect on the effluent quality. Since the treatment plant would receive wastes only 19 hours per day an air lift sludge return was employed to keep the sedimentation tank contents aerobic during the periods of no flow. For convenience of operation the air lift pump was operated continuously on excess air from the blower which was located adjacent to the kitchen in the main building. At no time have there been any problems from noise with this blower.

The treatment plant was finished and placed into operation on July 3, 1958, just before the biggest weekend of the season. A grab sample taken on July 24 showed that the treatment plant was operating satisfactorily with an effluent of 31 mg/L 5-day BOD. On August 7, a complete set of analyses was made at hourly intervals to determine the variations in operation. The average flow was 605 gallons per hour with a peak flow in excess of 1300 gallons per hour. This flow was considerably higher than expected and some solids were carried out in the effluent. In spite of the surge flow of 1300 gph, the effluent suspended solids averaged only 24 mg/L. The average 5-day BOD of the influent was 590 mg/L, while the effluent was 15 mg/L.



● **AERATION section of unit has been uncovered to show degree of aeration and agitation obtainable with ¼-inch holes in steel pipe. Cover planks are at right.**

Operation Problems

It soon became noticeable that the sludge in the sedimentation section was becoming septic in the corners and was rising to the surface. The intake on the air lift pump was modified to pull the sludge from the corners, but this failed to draw all of the sludge into the intakes. Since the problem lay in insufficient turbulence in the corners, efforts were made to deflect a portion of the mixing force into the corners by bending the deflection baffle. Unfortunately, the aeration system was not producing enough turbulence to reach the corners so that bending the deflection baffle did not produce satisfactory results.

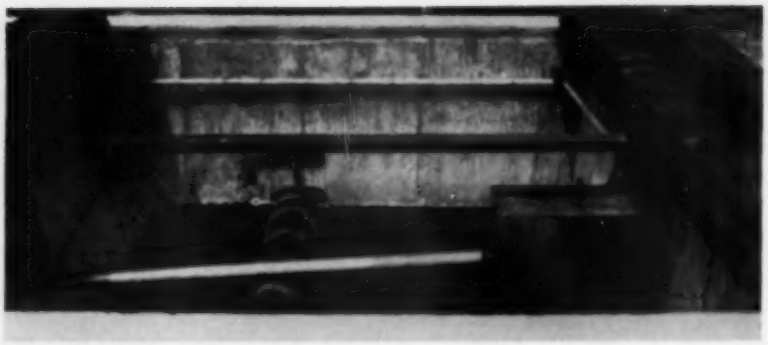
In January, 1959, a baffle was placed in the sedimentation section just below the liquid surface to catch the sludge which rose. The air lift pump intakes were set just below the top of the new baffle. A detailed study was made on plant operations over the next few weeks. The data, Table 2, showed that the effluent had deteriorated quite badly. The effluent was greenish colored and there was a distinct hydrogen sulfide odor. The baffle was removed in May, 1959, and a large mass of black digesting sludge was found under the baffle. Once again the air lift pump had failed to pull the sludge back into the aeration section so that it had built up under the baffle and had decomposed.

The Solution

The next step in trying to alleviate the rising sludge problem was the removal of the deflection baffle. It was expected that removal of the deflection baffle would create too much turbulence in the sedimentation section but this did not happen. The turbulence in the sedimentation section was perfect with the sludge having a slight rolling motion

approximately one foot below the liquid surface. The operation of the treatment plant showed an immediate improvement with the production of an effluent with less than 10 mg/L 5-day BOD and 20 mg/L suspended solids. Since May, there have been no problems due to rising or decomposing sludge.

With the successful solution to the rising sludge problem the treatment plant was turned over to A. R. Parker Company as being complete in all phases of design and operation. Operation of the activated sludge plant is essentially automatic with manual supervision and maintenance required at only two points. The air blower is kept lubricated at regular intervals to insure continuous trouble-free operation. Since there are no grease traps in any drain lines from the kitchens and since most of the grease is discharged to the sewer, there is a scum problem from grease ball formation. The grease balls are carried over into the sedimentation section where they float on the surface. The effluent weir is adjusted to form a scum baffle on one side so that the grease balls are retained in one area of the sedimentation section. These are removed manually once a week by using a large strainer on the end of a pole and are dried prior to being burnt in the boiler furnace. The grease balls are hard and crusty, are without odor and are handled without trouble.



● **SEDIMENTATION section, showing the air lift sludge return and the effluent weir, which is merely a steel pipe with V notches. Operation is essentially automatic.**

The total time required for this operation is about 30 minutes.

Since this plant was designed on the basis of total oxidation, it was realized that at periodic intervals there would have to be some removal of excess sludge or else it would be discharged in the effluent. In 15 months of operation, the excess sludge has been allowed to be discharged with the effluent. Even though the effluent flows in an open ditch for a considerable distance before reaching the receiving stream three have been no odors or nuisances created by loss of solids. Observation has shown that solids are discharged from the sedimentation tank immediately after cleaning of the ice cream vats. The surge discharge creates a hydraulic overload and washes out the excess solids. Once the ice cream vats have been cleaned and the flow returns to normal, the sludge level drops back to normal and a clear effluent results. No measurements have been made to determine the exact quantity of solids discharged in the effluent, but it has been estimated from laboratory studies to be approximately 10 percent by dry weight of the total ultimate BOD load. Based on the design criteria this would mean approximately 6 pounds of dry organic solids.

Simplicity and economics were two important criteria for the design of this complete mixing activated sludge plant. The plant definitely represents the simplest design possible from a structural standpoint, a mechanical standpoint and an operational standpoint. Aside from the weekly scum cleaning routine, the activated sludge plant operates itself automatically, adjusting the microbial mass to the variations in organic loadings. The plant has more than demonstrated its ability to absorb both shock hydraulic loads and organic loads without suffering upsets of the normal activated sludge system. The operating costs have been low for a small plant, with power and labor combined at approximately $4.00 per day.

The disposal of wastes from small industries such as A. R. Parker poses one of the major waste disposal problems at the present time. It is a definite challenge to sanitary engineers to provide adequate, economic and simple means for treating these wastes. The complete mixing plant described in this paper is not a perfect solution for all small waste treatment problems but it did solve the one for A. R. Parker.

Table 2—Summary of Operation Results

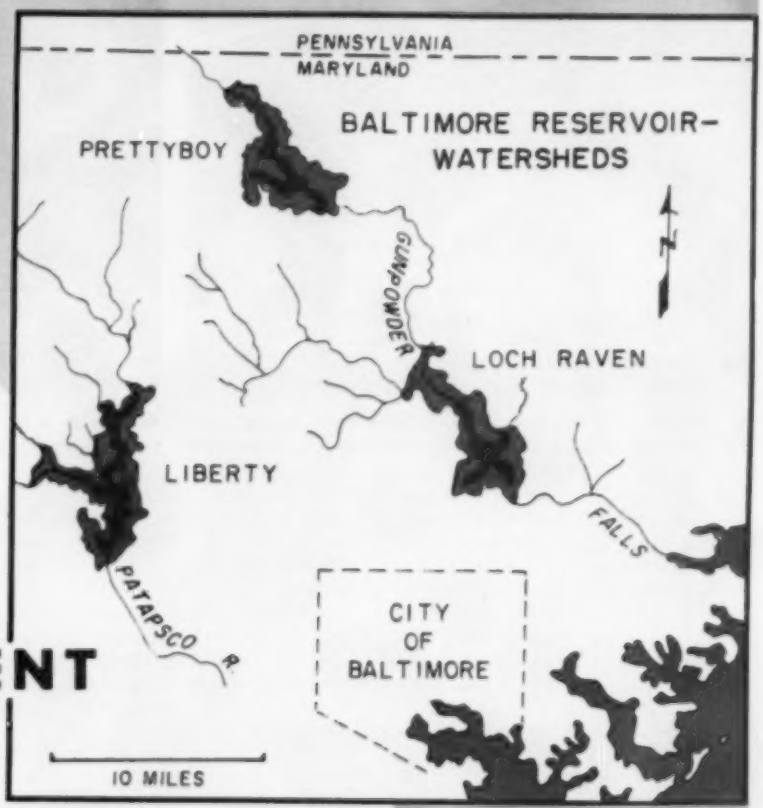
Date		Sample	Flow gph	5 Day BOD mg/L Inf.	5 Day BOD mg/L Eff.	COD mg/L Inf.	COD mg/L Eff.	Suspended Solids mg/L Mixed Liquor	Suspended Solids mg/L Eff.
1957									
Sept.	14	Comp.	285	815		1430			
Sept.	15	Comp.	460	560		1020			
1958									
July	24	Grab		590	31	1140	165	4320	58
Aug.	7	Comp.	605	590	15	870	135	3980	24
Sept.	10	Comp.	340	650	29	1530	194	5830	74
Dec.	31	Comp.	540	1385	10	8000	360	7500	59
1959									
Feb.	5	Grab		900+	15	3580	129	2640	24
Feb.	14	Comp.	580	1050	85	4350	315	2230	160
Feb.	19	Comp.	585	880	33	6920	104	2110	64
Feb.	26	Comp.	535	500	19	6280	106	1740	18
March	5	Comp.	600	300	42	5880	150	1050	56
March	19	Comp.	445	430	85	520	269	1910	70
March	26	Comp.	580	775	48	1760	250	3040	40
April	3	Comp.	490	814	56	1140	205	3930	20
May	21	Grab				500	118	6870	18
June	4	Grab		250	10	555	98	6800	11
June	25	Grab				1660	89	6330	18
July	9	Grab				1340	78	6620	17
July	16	Grab				996	57	6212	5.6
July	23	Grab				1580	199	6580	98

Reference

McKinney, R. E., Symons, J. M., Shifrin, W. G. and Vezina, M., "Design and Operation of a Complete Mixing Activated Sludge System", *Sew. & Ind. Wastes, 30,* 287-295 (1958).

THE BALTIMORE WATERSHED . . .

AN EXAMPLE OF GOOD MANAGEMENT



● **WATERSHED of the City of Baltimore, showing principal reservoirs now in use.**

IRVIN C. REIGNER,
and
WALTER C. SUSHKO

Irvin C. Reigner is a research forester at the New Lisbon (N. J.) Research Center of the Northeastern Forest Experiment Station, U. S. Forest Service. Walter C. Sushko is the forester for the Water Supply Bureau of the City of Baltimore, Maryland.

THE DENSELY populated Northeast depends to a great extent on forest cover to protect municipal water supplies. Both watershed and reservoir protection are sought: watershed protection to keep streamflow unpolluted, and reservoir protection to take advantage of the soil-stabilizing, sheltering influence of trees planted along the shoreline.

In all, 339 municipalities in the Northeast—about one-third of the population—use forested areas for this purpose. These areas vary in size from a few acres of planted conifers screening a reservoir to the more than 86,000-acre area managed by the Metropolitan District Commission of Boston. Most of them are public lands, either municipally owned or reserved from state and Federal ownerships. However, private water companies own large holdings in Pennsylvania, Connecticut, and Massachusetts.

Municipal ownership of watersheds is not a new development in conservation. Their acquisition was first authorized by Massachusetts in 1882 (4). Many watershed forests were established from 1900 to 1920, the era when many community forests were created. This was largely before the time of chlorination, and watershed sanitation consisted of natural purification by long storage in reservoirs (2).

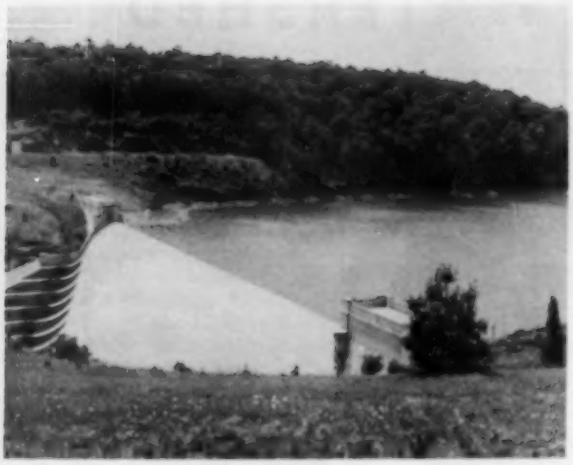
Watershed Management

For many years not much was done with the forest lands except to protect them. Fire protection, and fencing and patrolling to prevent trespass were the essential tasks. The forest guarded the water supply and the water department guarded the forest. Under such protection, the watershed forests and the plantations encircling reservoirs grew in volume and increased in value as they protected an increasingly valuable water resource.

By the 1930's, plantations established on reservoir shorelines in the early part of this century were producing salable products. By then, second-growth forest watersheds, purchased originally for protection, had been inventoried, and management plans were common.

By the 1940's, research of the U. S. Forest Service was demonstrating that a forest that guarded water also used a lot of it, and that forest cutting could increase water yield. Research men also found out that cutting of the forest must be done carefully to maintain its protective function. Special care must be taken in location, construction, and maintenance of logging roads.

These developments have increased the responsibilities of municipal watershed managers. Their prime responsibility remains the protection of water supplies; but added to that they now have opportunities to augment municipal income through sale of forest products, and, perhaps in the future, means of influencing yield through forest management.



● SPILLWAY of the dam at the Liberty water supply reservoir. Heavily wooded shoreline is typical of the watershed.

● SLASH is used as a protective agent on skid roads to prevent erosion. Slash decomposes quickly, improves drainage.

A good example of the development of a watershed management program and of a city's reliance on forest protection of reservoir shorelines is that of Baltimore, Maryland.

The City of Baltimore owns 17,300 acres of watershed lands. This places Baltimore—sixth ranking U. S. city with a near-million population—among the larger municipal forest landowners in the East. These watershed lands surround the city's three water supply reservoirs: Loch Raven, Prettyboy, and Liberty. All three are located to the north and northwest of the city in Maryland's Piedmont region. The most distant reservoir, Prettyboy, lies some 25 miles from the city limits.

Baltimore's first water-supply reservoir was Lake Roland, built in 1862 just north of the city. For years, a losing battle was waged against silting in this reservoir. Only 10 years after completion, a wheelbarrow and cart excavation of sediment was started, to be replaced a few years later by a suction dredge —one of the earliest records of such an operation in the United States. By 1900 at least 142 acre-feet of sediment had been dredged from Lake Roland (1). In 1916 it became necessary to abandon the lake as a water supply.

Meanwhile, by 1881 the Loch Raven Reservoir had been built. In 1910, the city began purchasing land in the vicinity of Loch Raven to enlarge the reservoir, and two years later work was begun on a new Loch Raven dam. In 1922, this dam was raised to its present elevation.

Since then, two more reservoirs have been added to Baltimore's water supply system. Completion of Prettyboy dam in 1933 created another large reservoir upstream from Loch Raven. Watershed lands around Prettyboy Reservoir were acquired from 1925 to 1930. But constantly increasing demands for water dictated additional development, and in 1942 the city began purchasing lands along the Patapsco River. Here the Liberty Dam was finished in 1955.

Sedimentation has been a continuing problem. As stated, Lake Roland was abandoned as a reservoir because of it. The original Loch Raven reservoir lost 85 percent of its capacity within 20 years of its completion, even though 500,000 cubic yards of silt had been dredged from it during that time (3).

Capacity losses due to sedimentation have been less spectacular in the newer reservoirs because they are much larger. Even if the amounts of sediment had remained the same, the capacity of the Loch Raven Reservoir has been increased over 50 times so that proportionally sedimentation would have proceeded at a much slower rate.

Nevertheless, any sedimentation results in the loss of some reservoir capacity. Considerable effort has been made to reduce the rate of sedimentation For many years, the sole purpose of the forests on city-owned watershed lands was to prevent erosion. No timber cutting nor any other use of watershed lands was permitted. Forest-management practices were limited to fire protection and to planting over 700 acres of non-forest lands.

Within recent years, this initial approach to watershed management has undergone important changes. The present Director of Public Works, Bernard L. Werner, recognized that along with water resource values were values to be derived from the watershed forest. Accordingly, a management program was developed to serve the dual purpose of timber production and, through controlled forest use, better water production. Under this program the sale of forest products could yield considerable revenue to the city and, with careful management, no decrease in water quality need occur.

This management program would also have demonstration value. While the 17,300 acres of watershed land is a large municipal holding, it is still only about 6 percent of the total drainage area above the reservoirs. Obviously, the land-use practices of neighboring owners are important to the city. And by proper management of city lands these other owners might be encouraged to follow policies that would benefit both the city and themselves.

To bring about a change in program, a Watershed Control Division was created in 1954, headed by Louis G. Ningard from the Water Supply Bureau. The stated objective of the new Division was:

". . . to plan, manage, and supervise a coordinated conservation program of forest, soil, and water, which is based on the principle of multiple use of 17,300 acres of watershed lands for water protection, timber-growing, improvement and utilization of timber resources, and recreation. In addition, this Division is responsible for soil erosion prevention, conducts its own sanitation control, and constructs and maintains necessary facilities." (7)

The Watershed Control Division

● **PLANTINGS of loblolly and white pine have been made on the Liberty watershed. So far, loblolly outgrows white pine.**

employed on its staff a forester to plan, develop, and supervise the whole forestry program on the city's watersheds. Among other duties, he marks timber for removal, lays out the forest-road system, supervises logging, and treats roads and skid trails after logging. Heavy equipment was purchased—bulldozers, logging tractors, log trucks, and a loading crane. A permanent sawmill was built and a crew of 17 men was assigned to sawmill and logging operations.

The Timber Resource

Through years of protection, the timber on the watershed property acquired considerable value. Mixed hardwoods—yellow-poplar, the oaks, hickory, red maple, and beech—comprise the bulk of the forest stands. Chestnut was a major species in the past. Virginia pine is common; it occurs in pure stands but more often in mixture with hardwoods and with pitch pine. On all three watersheds, many of the trees in the hardwood sawtimber stands were old limby individuals with considerable defect.

Fire records were not kept before the creation of the Watershed Control Division, but it is known that wiid fires were frequent and destructive. Many trees are fire-scarred, and butt rot is common. About 876 acres of Prettyboy watershed still bear visible signs of fire damage. The Division staff is trained and equipped for fire-control duties and is a cooperative unit of the State fire-protection system.

The Management Plan

Following creation of the Watershed Control Division, a timber-cutting program was initiated in 1955 on Loch Raven watershed. Stand improvement is a primary objective: overmature, defective, and low-vigor trees are marked and cut, releasing the more vigorous growing stock. In the oak types, marking is based on the selection system, with a well spaced all-aged stand as an ultimate objective. On those sites where less tolerant species such as yellow-poplar are to be encouraged, larger openings in the forest are created.

The entire Loch Raven watershed has been divided into management units, and these were further split into sub-compartments of uniform forest type. All logging is done by the Bureau's own labor force, which allows close supervision and compliance with the watershed-protection program.

Almost all the timber cut on the watersheds is sawed at the Bureau's sawmill, located on Loch Raven watershed. From November 1, 1955 through June 30, 1959—a period of more than four and a half years—6,441,430 board feet of lumber were produced. Of this, 5,834,304 board feet were disbursed. Its value was $519,853.59—an average of $12,090.00 per month. Although accurate figures on the cost of producing this lumber are not available, it is evident that the forest-management program is financially rewarding.

Great care has been taken so that timber harvesting would not injure

● **STUDIES on the effect of vegetation on water yield and distribution are conducted at three small research watersheds. This is one of the streamgaging stations.**

water quality. Logging roads were built and maintained according to research-designed practices (5), (6), (7). Preliminary location of permanent forest roads is done by the forester from aerial photographs and topographic maps; the final location is then marked on the ground. All roads are laid out with the lowest grades on side-hill slopes away from stream channels. Where roads have to cross streams, culverts are used.

In logging, a certain amount of damage cannot be avoided, especially when crawler tractors are employed. But it can be corrected. After logging is completed, all permanent roads are regraded, and water bars are installed by making a wide, shallow sweep with a dozer blade. As a supplementary measure, those sections of roads on grades are revegetated. Weeds and grasses, cut on the City's grasslands just before seed-ripening time, are baled and used as a mulch when needed. In this way the road is seeded at the same time it is mulched.

A well-designed and well-constructed permanent road system has several economic benefits. First of all, log hauling is faster, and easier on equipment. Second, being permanent and easy to maintain, roads will be available for future logging. Amortized over a period of several rotations, the cost charged to each logging job is much reduced. And finally, the roads are available for other access, chiefly for fire control.

Under this program, a total of 15 miles of permanent forest logging roads were constructed from 1955 through 1958 on the Loch Raven watershed. Roads are checked annually to make sure the drainage structures are functioning and that they are passable in case of emergency.

Slash is also used as a protective agent. It is lopped and placed on old skid trails at such angles as to lead surface runoff out of the trails at frequent intervals and thereby prevent erosion. In contact with mineral soil, the slash decomposes faster, thus reducing fire hazard, and improves infiltration in the skid trails. Streams are always cleared of any slash from the logging operation.

Forestation

Up to 1958, the City of Baltimore had planted 2,299 acres, mostly to conifers, predominantly loblolly and white pine. The oldest plantings—many dating back to 1912—are on Loch Raven watershed. About 700 acres of plantings range in age from 26 to 47 years. Present planting is confined to the more recently acquired Liberty watershed, where 660 acres have been planted in the last four years.

Hardwood sprouts and honeysuckle hinder the growth of young plantations. Methods of controlling hardwoods with herbicides are well known, but research is still continuing on honeysuckle control. Some of this research is being conducted on Loch Raven watershed in cooperation with the Northeastern Forest Experiment Station and the Maryland Department of Forests and Parks.

Recreation

Public recreation is the third major use provided by the Baltimore watersheds. As on all publicly owned lands, the demand for recreation facilities is already considerable and is growing.

The Division of Watershed Control recognized this need, and several years ago began providing facilities on a trial basis. Well over 100 picnic tables are maintained on the three watersheds, but campfires are prohibited. Fishing and boating are allowed under special permit at Liberty and Prettyboy reservoirs, providing a cash revenue. Deer hunting with bow and arrow is permitted on Prettyboy watershed. No swimming is allowed on any of the three reservoirs.

Research

To complement its management activities, the City of Baltimore is conducting several cooperative research projects on its watersheds, in addition to the honeysuckle study already mentioned Outplantings of several tree-improvement studies carried on by the Maryland Department of Research and Education are located on Prettyboy watershed. These outplantings are replicates of a widespread study of the racial variations of Virginia pine, Austrian pine, and Scotch pine.

The major research project is in cooperation with the Northeastern Forest Experiment Station. Three small sub-watersheds are being studied intensively to determine the effect of vegetation on water yield and distribution. All three areas are equipped with V-notch streamgaging stations to measure water yield. Precipitation, air temperature, and relative humidity are also measured on the watersheds.

Two of the watersheds were planted to loblolly pine several years ago, and the third watershed is presently forested. They are now in the process of calibration; after that is completed, the vegetation will be treated and the effect on streamflow will be determined.

Results of this research will be used not only to guide the watershed management on reservoir lands but also as a means of evaluating the effect of forest planting and practices on the watershed area above the reservoirs. In carrying out this research as well as its management program, the City of Baltimore hopes to stimulate interest and practice in forest and watershed management throughout the whole of its water-source area.

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SAFETY IN REFUSE COLLECTION

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Photos Courtesy
Department of Sanitation,
City of New York

ACCIDENTS, the object of great and largely successful preventive efforts on the part of private industry, are still regarded by many municipalities and refuse collection contractors as "acts of God." Such overly-casual attitudes toward accidents can be attributed only to a lack of awareness of the costs. Many are hidden, some are intangible; but, taken together, the silent sabotage of accident losses adds up to a problem calling for top managerial attention.

Successful prevention saves pain and disablement; saves loss of labor time; saves the expense and time of administrative procedures which follow an accident; and saves money in a variety of ways. At the top of the list, of course, is the savings in death, disablement or discomfort--matters of personal anguish which cannot be measured entirely in dollars. Money measurements can be applied to the expense of a replacement employee, sick pay or disability pay, the increase in workmen's compensation costs, the expense of repairing physical damage to equipment and down time for the crew and the equipment. Following an accident there are special administrative routines which would not otherwise be necessary. The injured man must be replaced, claims must be processed and accident reports made out.

A chain of costs are attached to accidents that can be avoided only by preventing the accident itself.

The common statistical terms in accident reporting are the *frequency rate*, which means the total number of disabling injuries per 1,000,000 man-hours of work; and the *severity rate*, which is the total number work days lost per 1,000,000 man-hours of work. Statistics on accidents in garbage and refuse collection are not extensive, but a few that are available will give some perspective.

The figures cited in Table 1 are from "Accident Rates" of the National Safety Council and provide a basis for comparing the safety record of other industries with that of refuse collection.

● CLASS of new employees being instructed in the principles of air brake application by the Director of Safety. A working model is used in the lecture.

Table 1—Frequency and Severity Rates for Accidents in Selected Industries, 1958

Industry Group	*Position Among All Industries*	*Frequency Rate*	*Severity Rate*
Marine Transportation	Worst frequency record	33.23	1,214
Coal Mining	Worst severity record	27.39	5,975
Communications	Best record	.97	85
Construction Industries		16.99	2,538
All Industries		6.17	744

The National Safety Council also compiles figures on the safety record of certain governmental and "governmental-type" units. These are shown in Table 2.

As Table 3 shows, a favorable frequency rate for cities cited is 24.5 in San Diego, a city recognized for its efficient administration; yet this rate is four times as high as the all-industries record and nearly as high as that for marine transportation, which has the highest frequency rate for any major industry group. The severity rate for the cities cited is on the average, about the same as the all-industry figure. Kansas City and New York City have a severity rate substantially below the all-industry average.

Only limited conclusions can be drawn by these comparisons and figures. Refuse collectors undoubtedly are confronted by more hazards than employees in most other occupations, and some of the dangers can result in severe, as well as minor accidents. In addition, there are different hazard levels in different cities. Narrow streets, old equipment, variation in requirements for refuse containers and other factors can account for a more dangerous environment for the department in city "X" as compared to city "Y".

Figures reported in Baltimore's 1957 *Employee Accident Statistics*, shown in Table 4, serve to illustrate the comparative danger of refuse collection (including disposal) in relation to other categories of municipal service in the public works department.

The Common Accidents

Kansas City reports its most common personal injury accidents are from lifting, sprains and dog bite. San Diego has found that "injured backs, cuts and strains" lead the list. In an article in *Public Management* in 1943, Kent W. Francis of the Industrial Division of the National Safety Council listed the most common accidents in garbage collection as strains and hernias, vehicle hazards, cuts and other injuries from handling materials and disease hazards (6). New York City's records of the most common types of accidents are revealing. As the following list shows, human error is involved in most accident situations:

Taking unsafe position	194
Working on dangerous equipment	71
Operating at unsafe speeds	28
Hazardous arrangement	15
Defective condition	10
Unsafe dress	10
Unsafe loading	5
Failure to use protective devices	4
Others	11
Total	348

The injuries resulting from the accidents are also compiled by the New York department on the basis of the part of the body injured:

Trunk	114
Legs or feet	92
Hands or arms	71
Eyes or head	48
Hernia	10
Internal	10
Fatalities	3
Total	348

To look at the accidents from another viewpoint, it can be said that there are four circumstances in which most accidents take place:

1. In driving and riding trucks (including circumstances where truck is moving and crew is on the ground);
2. In loading: a) getting, lifting and carrying containers, b) filling hopper or other loading action including mechanical loading cycle;
3. In unloading; and
4. In cleaning the vehicle.

How to Cut Accidents

The city of Richmond, Virginia, (7) reduced the accident frequency rate among its refuse collection and street cleaning employees by 50 percent in 1951. In the same period the severity rate was cut 33 percent. These improvements followed the creation of a small operating safety committee. The committee met monthly to investigate all accidents, near-accidents, and hazardous conditions, and to recommend corrective measures. In addition to its primary concern of creating a better attitude in employees concerning accident prevention, the steps taken included the interesting one of "installing buzzers on trucks equipped with air brakes."

Between 1945 and 1952 the city of San Diego (8) succeeded in cutting in half both the frequency rate and the severity rate for all city employees. During this period a system of safety meetings was set up, with a monthly forty-five minute period held on city time. The importance of such meetings was emphasized by

Table 2—Frequency and Severity Rates for Accidents in Selected Governmental and Governmental-type Units, 1958

Unit	Frequency Rate	Severity Rate
State Highway Depts.	10.96	1,481
Water Utilities	17.69	1,009
Municipal Employees	15.04	539
Police	27.07	1,094
Fire	21.63	1,886
Parks	20.29	430

Table 3—Frequency and Severity Rates for Accidents in Refuse Collection Service in Selected Cities

City	Time Period	Frequency Rate	Severity Rate	Motor Vehicle Action Cases per 100 vehicles	Accidents per Refuse Collection Vehicle	Accidents per 100 Employees
Baltimore (1)	1957	101.52	—	—	—	—
	1958	116.11	—	—	—	—
Kansas City (2)	1958	—	413	—	1.6	52
Milwaukee (1)	1958	107.4	912	—	—	—
New York (3)	1958	16.61	432(a)	.163	.646(b)	12.0(c)
Various	1956	51.2	—	—	—	—
Sanitation Departments (4)	1957	53.6	—	—	—	—
San Diego (5)	1957-8	41.5(d)	966	—	.30	9.0
	1958-9	24.5	732	—	.19	5.0

(a) Rate without fatalities; the rate with fatalities was 1,291. (b) Computed on basis of typical number of vehicles in use on a given day, 1801, and "action accidents" involving property damage, 1165. Figures supplied by Paul R. Screvane; computation by author. (c) Computation on basis of 9680 employees and 1165 action accidents involving property damage. (d) Computed on basis of lost-time accidents only.

the city records which showed that in 1945-47 approximately 94 percent of the accidents were due to human failure and 6 percent were due to defective equipment. In 1950 the figures were 97 percent and 3 percent respectively.

Some of the human failures included lack of rest, poor physical condition, personal problems causing lack of attention to the job, daydreaming, faulty observation, negligent attitudes and taking chances.

As a result of the improved record in 1952 the city saved some $59,000 or almost $5,000 per month in workmen's compensation insurance payments.

Instead of the "committee" approach, New York City's Department of Sanitation attacks accidents through a special full-time staff operating as a separate division of the department. The division is manned by a Director of Safety, seven Assistant Directors, one sanitation man, and a clerical staff of five. Among the responsibilities of the Division of Safety are these:

1. To develop and administer in cooperation with operating bureau heads programs to reach safe practices and accident prevention.

2. To supervise systematic reporting and analysis of all accidents and injuries.

3. To investigate all occurrences from which there may arise against the city claims for personal injury or property damage, and, in connection with this work, to maintain liaison with departments and bureaus concerned, the Workmen's Compensation Bureau, the Law Department, etc.

4. To operate the departmental Driver Clinic.

5. To maintain liaison with public and private agencies working in the field of accident prevention.

6. To procure and to supply training and safety materials and equipment as required for effective and safe operation.

● **TRUCK is improperly positioned for making right turn, resulting in a "squeeze play" on the automobile shown. Instruction in safe driving reduces traffic accidents.**

There are several unusual aspects of the work of the Division of Safety, some of which may provide leads for modified programs in sanitation departments of smaller size. For example, employees returning to duty after sickness or injury are examined by the Chief Medical Officer or a physician on his staff. Where the employee's condition warrants it, he is given a work assignment less arduous than normal. In this way the possibility of aggravating an injury is minimized.

A remarkable number of articles of safety equipment have been purchased or especially devised as a result of studies of accident data. Among such items are respirators and eye shields for power broom operations; reflectorized belts for employees working at night (the department has some 400 vehicles in operation during the night hours); life rings and belts for marine operations; safety belts for incinerator operations; goggles of all types to protect against eye injuries for welders, burners, chippers, grinders, etc.; special steel-faced gloves for men handling wire cable; special plastic-dipped gloves for broom-stripping operations; rubber gloves and aprons for men handling chemicals and acids; safety helmets to protect men from falling objects; and specially devised paint spray booths with exhaust hoods for locations where equipment is spray-painted.

Departments plagued with a small number of employees who seem to have the lion's share of vehicle accidents may find New York's experience with its driver clinic to be of special interest. The present driver clinic grew out of the Department's Accident Repeater Clinic which was created in 1954. The clinic looks into the underlying factors in the involvement of individual drivers in an abnormal number of accidents, that is, a repeater group; and through screening of all employees entering the department, it establishes a basis for training the new men.

A series of physical, psychophysical, knowledge and attitude tests were developed. The test results are tabulated and forwarded to the employee's superintendent with recommendations. Where driver difficulty is not remediable the employee is assigned to non-driving duty. In the years since the establishment of the driver clinic the number of motor vehicle action cases per 100 pieces of equipment has steadily decreased from 231 in 1955 to 181, 173 and 163 in 1956, 1957 and 1958.

Safety Training Program

If there is one thing the accident experience of sanitation departments in Richmond, San Diego, New York and well-run depart-

Table 4—City of Baltimore Accident Statistics, 1957

Bureau of Department of Public Works	Disabling Injuries: Frequency Rate	Disabling Injuries: Severity Rate
Building Inspection	14.01	8,675
Highways	19.17	135
Mechanical-electrical Service	20.88	287
Sewers	22.77	523
Surveys	20.14	87
Transportation	21.46	189
Water supply	19.87	172
Sanitation	36.05	2,148

● **STEAM cleaning collection vehicles can result in accidents unless proper procedures and equipment are used. This shows protective equipment for the operator.**

ments in other cities have in common, it is a conscious and sustained effort to improve the safety record. This is another way of saying that they have a program.

As in any other new project, half the battle in a safety training program is in organizing it—overcoming inertia and starting things moving. Fortunately there is no mystery about the way to organize a safety training program. The main features are essentially these:

1. *Put someone in charge.* The top administrator cannot himself directly organize and oversee a safety training program. He must delegate the job to someone, and must give that person the authority to act and the responsibility for results. The size of the funds allocated for the program should be agreed upon and tentative target dates set for initiating various key phases of the program. The top administrator must be kept informed of the progress and the major problems in organizing the program. Occasionally there will be statements or action needed that can effectively be done only by the top administrator.

2. *Enlist key officials.* It is unlikely that much real progress can be made in accident prevention if key officials of the department are not behind the program. The needed support can usually be achieved if the advantages of the program are made clear and the views of these officials solicited as to what the program should include and how it can be presented most effectively. If the officials are given a sense of participation their interest and support are normally assured. Often their suggestions, based on experience, can be of real help in formulating a program that will be effective.

3. *Train supervisors* for their safety roles before proceeding with the general training. This need not be a course of any great length nor need it contain much substantive information about safety. The objective is simply to show the supervisor how he fits into the prevention program and what his special supervising responsibilities are.

● **TESTING for oxygen deficiency in the refuse storage pit at an incinerator. A program to insure performance of such measures reduces accidents.**

4. *Consult all employees* on safety needs. This can be done by using the "slip" technique: employees are assembled in relatively small groups (preferably not more than about 25) and are given small slips of paper. They are asked to write down on separate slips the two or three things they see as danger spots on the job. The slips are collected, and the results summarized and reported. A session of this nature should, of course, start off with an explanation of the reason for the meeting, the tentative plans for instruction, and a statement that all members of the department are being asked to give their ideas so that the program will have a practical basis.

The views of the workmen will, of course, be of great value, but there are two other advantages in the public relations aspect of this step. The men will probably be pleased to know that their ideas are wanted, and, in thinking about the safety needs, they are made alert to safety matters.

5. The meeting place and the hour for meeting can be only locally determined, but both decisions can influence the effectiveness of instruction. A quiet meeting place with no distracting features is best and the meeting should not be held on the employees' time. Garbage and refuse collection is heavy work and at the end of the day the men are naturally going to feel fatigued. The best time would therefore be just before work is begun.

6. *Reserve* the meeting place; a simple move, but it can prevent a lot of woe.

7. *Line up instructors.* In fairness to the men and the instructors this arrangement should be completed well before the course starts. Instructors of monotonous voice, or with a tendency to read a lecture are inadequate. Informality, knowledge of the subject, and an ability to engage the men in discussion are some of the instructor's prime requisites. Expect to pay for good instructors, unless there are good ones in the department.

8. *Publicize the meetings.* Orally and through written notices the employees should be told—and reminded—about the safety training sessions before they start. This will help to assure that all hands will be present and that they will know what to expect: how long the ses-

(*Continued on page* 198)

Experimental Operation OF INDUSTRIAL WASTE STABILIZATION PONDS

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and
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THE CITY of Grandview, Washington, was faced with the problem of having to dispose of the wastes from six different food processors. These are the Yakima County Grape Processors, Libby's Cannery, Tea Garden Products, a winery, Welch's Grape Juice Plant and a custom cannery. Most of the waste was from the first four listed above. Two or more new canning plants were expected in the near future. The waste consists now mostly of grape juice, corn and wine; but in the future it will include potatoes. This waste has been treated by an aerator-clarifier which was much too small, resulting in the discharge of poorly treated waste water.

In the summer of 1957, the city constructed three small oxidation ponds. These, put in without any planning as to the size, type, or method of operation, were located on the edge of town in a residential district and near the existing treatment plant. They were connected to operate in series. The first two ponds had areas of 1.5 acres each; and the third pond 0.5 acre; the total area was 3.5 acres. During the summer of 1957, the loadings were not controlled and the ponds were greatly overloaded. They soon developed an odor which continued all summer and resulted in strong complaints from nearby residents.

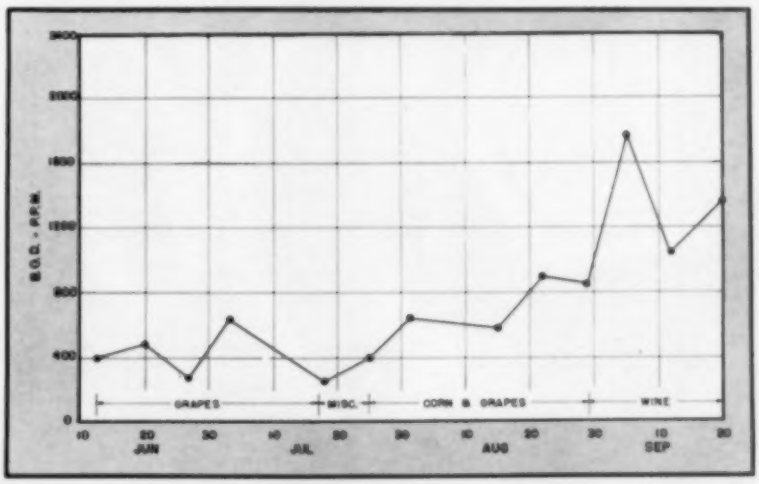
In the spring of 1958, the city hired a consulting engineer to make a study of the problem. About the same time the Sanitary Engineering section of the Division of Industrial Research of the State College of Washington became interested. After meetings with the consulting engineer, the city gave the college permission to operate the ponds during the summer of 1958. It was agreed that the loadings would be closely controlled and that at the slightest odor, the ponds would be shut down. It was also agreed that the college would work on the project with the help and under the direct supervision of the consulting engineer.

The first pond inlet was changed to a pipe discharging at the center and near the bottom of the pond. A gate and a Parshall flume were installed in the inlet pipe so that the flow could be regulated and measured. The flow of waste not turned into the ponds continued down to the aerator-clarifier as before. Weirs were installed in all of the pond outlets and one was placed in a ditch so that irrigation water, which was added for the purpose of maintaining a flow in all the ponds, could be measured. Arrangements were made with the State Health Department for the use of its truck-mounted laboratory. The city also made available for the use of the college, the laboratory facilities at the domestic sewage treatment plant.

During the last of May, irrigation water was turned into the ponds which were full to a depth of three feet on June 5. The first waste was started into the ponds on June 9. This waste was allowed to flow into Pond I for eight hours per day. This controlled the flow more accurately and better measurements of the BOD could be made.

Analytical Work

The following tests were run on the ponds: Dissolved oxygen, alkalinity and pH. These tests, along with the noting of the climatic conditions, were recorded three times a day. The BOD of the influent, composed of hourly waste samples, and the flow in and out of every pond was recorded daily. The BOD of the effluent of the three ponds was taken every other day. The flow or irrigation water was controlled in order to keep it to a minimum and still



● **FIG. 1. This diagram shows the BOD of the influent wastes, illustrating the variations due to grape waste, corn and grapes mixed and the inflow of wine waste.**

maintain a flowout of the third pond.

Starting in the middle of July, the COD test was used to control the loading of Pond I. This test permitted better control of the loadings, because the COD values can be obtained within an hour of sampling, whereas the BOD values require five days. At this time the operator started filtering the effluent before either the COD or BOD tests were run on the samples. It was found at a later date that without filtering the influent, one could not compare the COD and BOD values as there was no agreement between the two. Except for the period when the influent was not filtered, the correlation between COD and BOD was very good.

Experimental Loadings

The waste to be treated in these ponds was almost all grape waste until July 17; the average BOD for this waste was 450 mg/L. From July 17 to August 30, the waste consisted of mostly corn with some grape; the average BOD was 710 mg/L. From September 1 until the ponds were shut down on September 17, the waste was almost entirely from the winery with an average BOD of 1390 mg/L. The influent BOD for any one day varied from 120 in July to 2900 mg/L in September.

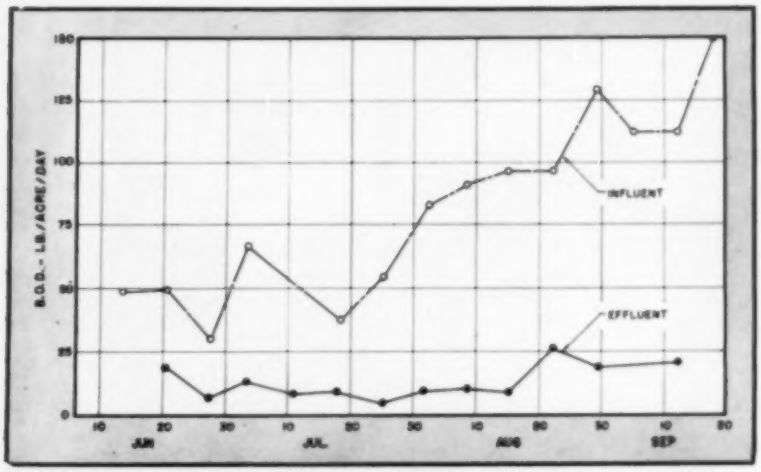
The loading on the first pond was increased from 29 pounds per acre per day in June to 150 pounds per acre per day in September. During the period from June 10 to July 18, the loading varied from 29 to 67.5 pounds of BOD per acre per day with an average of 47 pounds. During this period the average efficiency was 78.5 percent and the effluent of this pond was usually below 20 mg/L. The strength in mg/L of the effluent of Ponds II and III was about the same as Pond I. During this period the three ponds reduced the BOD by about 95 percent.

During the first week of the pond operation, while the first pond was being loaded at an average of 48.5 pounds of BOD per acre per day, the DO dropped to 1 or 2 mg/L in the morning and about 3.5 mg/L in the afternoon. By June 16 algae began to be visible in the ponds, with the result that the DO rose to 3 to 4 mg/L in the morning and as high as 14 mg/L in the afternoon. During the rest of June and until July 17 the evening DO was always between 8 and 16 mg/L.

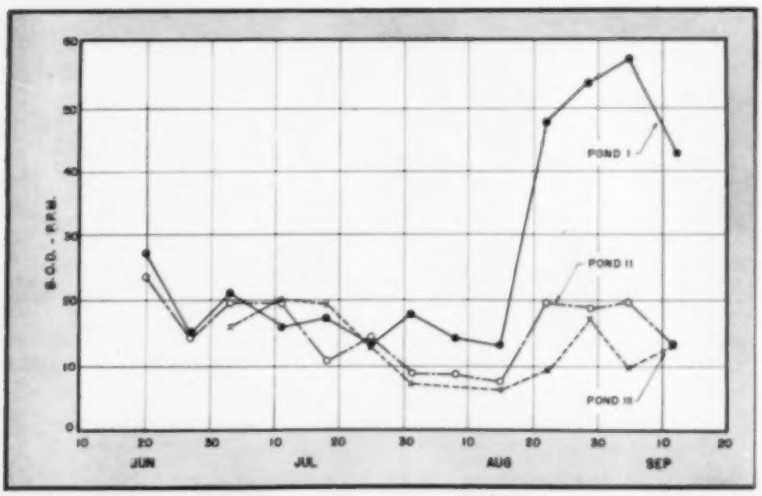
Beginning on July 17 the loadings were increased slowly so that on September 15 the ponds were being loaded at 150 pounds of BOD per acre per day. The average efficiencies of the ponds over the summer were 81 percent for the first pond, 61 percent for the second pond, and 82 percent for the third pond. The final reduction of the waste was 93 percent after the second pond and 99 percent after the third pond. During this increase of loading, the first time that the DO ever dropped below one mg/L was on August 26. At this time the loading had been raised from 100 pounds per acre per day to as high as 150 per acre on some days. This was the period where difficulties occurred with the correlation between the COD and the BOD tests. After shutting off the waste flow for the weekend the previous loading was resumed and the ponds were operated for three more weeks.

At the time the ponds were closed down on September 17, the DO of Pond I varied during the day from 1.3 to 7.2 mg/L. The pond was giving off a little odor from 3 AM until about 8 AM, and some of the algae were beginning to die. But even during these last weeks of operation, the efficiency of the first pond remained above 79 percent with the efficiency of all the ponds near 100 percent.

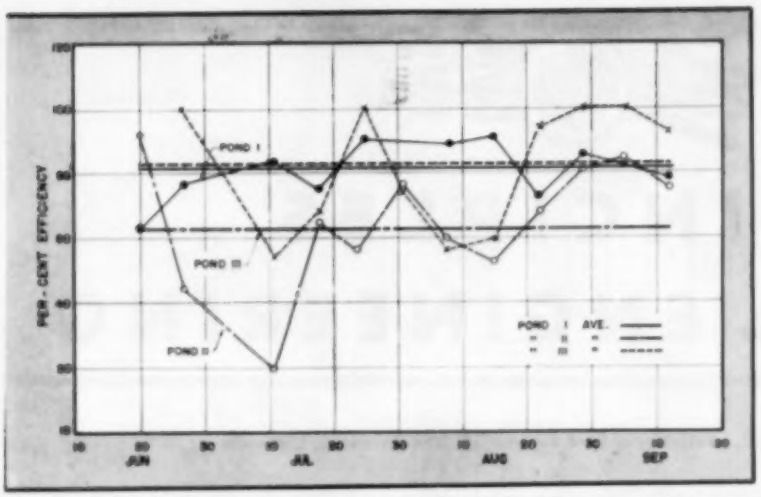
Irrigation water was added to Pond I all summer in an effort to keep an outflow from Pond III all the time. However, this was not accomplished. The irrigation water averaged 122,000 gpd and the waste flow averaged 22,000 gpd. This flow of waste ranged from 10,000 to 35,000 gallons per day, depending on the results of the oxygen demand of the waste. The average flow out of Pond III was 10,000 gpd; the total loss from the three ponds was 134,000 gallons or 1.45 inches per day. The seepage and evaporation rate



● FIG. 2. Pond 1 BOD record shows the variations in the strength of the influent and the effluent as the type of waste changed; pounds of BOD per acre per day.



● FIG. 3. Effluent of the three ponds are shown separately in terms of parts per million of BOD. Note small variation in effluents of second and third ponds tested.



● **FIG. 4. Pond efficiency in percent removal. Conclusion of tests was that use of series of ponds is justified only when BOD load is high or there are shock loads.**

of an oxidation pond should not exceed ¼ inch per day.

Other Results

During the period from June 1 to August 18, the pH of the ponds ranged from 7.0 to 10.0, varying directly with the DO of the water. The pH of the influent during this period varied from 6.3 to 10.8 with the average about 7.2 or 7.3. The pH of the influent between August 18 and September 17 ranged from 3.0 to 6.5 due to the wine in the waste. This caused the pH in the ponds to drop to between 5.0 and 6.0. The alkalinity of the influent ranged between 130 to 190 mg/L; pond effluent alkalinity ranged from 50 to 100 mg/L.

The algae growth in the ponds varied with the climate, loadings and type of waste. The first algae growth was noticed on June 16. The growth increased and within one week covered the ponds with a light green scum when no wind was blowing. Soon after this a new type of algae appeared, the *Myxophyceae* species. This species took over the pond and became very abundant. When the winery started operating in August, this species disappeared and a new species took its place. During almost all of the summer the ponds had an abundant growth of algae in them.

Oxidation ponds are a successful method of treatment of cannery wastes. While the ponds did operate with a loading of 150 pounds of BOD per acre per day, we do not believe that this loading should be used in any design, except as the maximum shock load to be allowed for only a short time. When the pond was operating at 95 pounds of BOD per acre per day in the first part of August, the removal of BOD was about 90 percent in the first pond, with the effluent from 13 to 18 mg/L. The DO was from 8 to 14 mg/L in the evening and from 2 to 4 mg/L in the morning. At this loading there was a very good algae growth. We believe that an oxidation pond could be designed for a steady loading of 100 pounds BOD per acre per day.

Except where there are a lot of shock loads expected or a real low effluent BOD is needed, there seems to be no reason to have more than one pond. The second pond was needed when the loadings got higher but the third pond was never needed.

From the results of this study, it may be concluded that:

1) Ponds used for cannery and other seasonal organic wastes can be conservatively designed for BOD loadings of 100 pounds per acre per day, which is double the value of 50 pounds per acre per day, usually considered the maximum for sewage ponds.

2) More waste can be handled by a given area by a single pond or several ponds in parallel than by two or more ponds in series.

3) The use of series ponds would seem to be justified only when the BOD is considerably higher than 100 pounds per acre per day, or when high shock loads are common. In such cases, a second pond would appear practical as a means of insuring a low BOD in the effluent.

4. Where location permits, the operation of a first pond under anaerobic conditions, with probable odor development, followed by an aerobic pond, might permit an excellent effluent to be produced at an overall BOD loading considerably higher than the recommended 100 pounds. per acre per day.

This article is based on a paper presented at the Ninth Pacific Industrial Wastes Conference, University of Washington.

Filter Media Rearrangement Increases Flow Rate

Hanford scientists have found a way to improve filtering of water used to cool reactors so that twice as much coolant can be purified in the same time as with past methods, with a saving of more than $200,000 a year, and $250,000 in capital costs.

Millions of gallons of pure water must be pumped daily through the eight Hanford production reactors on the Columbia river. This water carries off heat produced by nuclear fission.

Higher flow rates and savings were achieved by changing the composition of the media in the filter beds and by the addition of a filter conditioning chemical to the settled water as it enters the filter. Money savings are obtained chiefly by reducing the amount of chemicals used for water treatment. The increased flow is attained in part by use of a bed with large average particle size.

The old filters at Hanford had 10 inches of sand, 10 inches of gravel and 20 inches of Anthrafilt. The new system uses the same amount of gravel, but only 3 to 6 inches of sand and 24 to 27 inches of Anthrafilt filter media.

Chemical treatment of the filters consists of continuous preparation of the filter bed to adsorb and retain the fine solid particles in the water immediately as it comes from the river. The chemical is added after coagulation.

The Hanford laboratories are operated by the General Electric Co. for the Atomic Energy Commission.

PRINCIPLES OF SOIL ENGINEERING

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AS HAS BEEN the case in the preceding two sections of this discussion, the special considerations involved with construction will be examined in light of the three basic factors underlying soil behavior: i.e. stability (shear), settlement, and permeability. Particularly when immediate action is required, the ability to utilize an expedient that will improve rather than detract from the ultimate structure is of real value. As will be seen, this is especially true where a stability problem is encountered.

The role of construction is viewed differently by those responsible for the design and proper execution of the work, and those concerned principally with the actual construction. In most cases, both parties have a sincere interest in achieving a permanent and economically maintained structure. Differences that grow out of the problems of construction are associated solely with differences in understanding of the behavior of the structure and its component parts. Sometimes one senses a feeling that the construction group are not wholly familiar with soil behavior, but the writer has not found this to be consistently true. In fact, many basic truths are demonstrated in "experience" rules followed by practical and serious construction men. The importance of the role of construction experience lies in the very fact that rational design procedures do not exist for many soil problems. Also, one factor must be recognized—not all of the "rules" followed by conscientious construction men are correct; in fact, some have adverse effects. The ability to understand basic soil behavior principles will inevitably produce the ability to judge the merits of the "voice of experience"; therefore, an understanding of these principles will be of significant assistance even though precise computation cannot be made for all construction problems.

It has also been noted that, on occasion, arbitrary and unnecessary standards are established by the design engineers—partly due to the failure of research to produce rational behavior laws, and partly due to lack of understanding of soil behavior. Throughout the following discussion, mention will be made of "end result" specifications, and the writer's prejudice for such specifications will become obvious. Here again, however, the engineer's inability to design precisely will restrict orderly progress toward earthwork specifications that are controlled solely by checking the final product. The writer has had much more experience in design and inspection than in construction. However, most of the following will deal with the influence of soil behavior in the construction phase, and will not attempt too much discussion of construction methods. The problems of soil behavior on construction is divided for convenience into the major areas of excavation, embankment, subgrade, and special problems.

Part III—CONSTRUCTION APPLICATIONS

EXCAVATION

Most of the special problems dealing with excavation are related to cave-ins in trenches and other structural foundation cuts. Herein, excavation is defined to include only cuts not fills. In some areas of the world, slope excavation produces a great deal of concern due to landslides and these problems are discussed in detail under a later section on "landslides." Additional detail on trench excavation is also included in a subsequent section on "Sewer Construction."

With very few exceptions, soil behavior problems in excavation are concerned with stability. Occasionally, permeability itself enters solely in a "nuisance" way, but even here major problems with water develop as a stability problem. One settlement consideration is related to subgrades that are located in areas to be excavated. In these cases, compaction is becoming more commonly required.

One of the important factors in excavation is whether rock or soil is involved. To the engineer, the term "rock" is not too uniformly used. The soil engineer tends to refer to any deposit older than glacial times as "rock" even though the material resembles a dry, com-

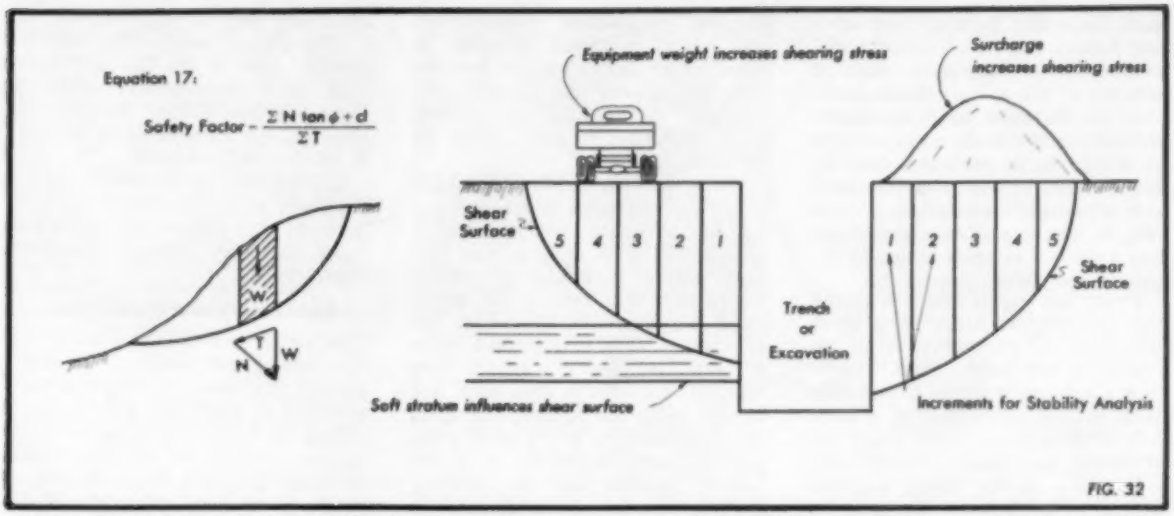


FIG. 32

● **SOIL STABILITY at the side of a trench or excavation may be analyzed and a safety factor computed by use of Equation 17; however, a competent contractor will generally rely on experience to determine the amount of bracing required. Factors which will decrease stability include equipment weight and material surcharge or penetration into a soft stratum.**

pact deposit of clay. The geologist tends to refer to "well-consolidated" or "poorly consolidated" materials and dislikes the reference to "bedrock" on the basis of ambiguity. Throughout this section rock or bedrock will refer to the ancient sedimentary, metamorphic, and igneous material that is still in place since its deposition prior to glacial time.

In trench excavations, this question continually arises: Is bracing necessary? The fact that construction men are still gambling on the necessity for or strength of bracing is attested to by the almost daily mention in the press of another injury or fatality due to a cave-in. Such problems arise strictly due to shear failure in the soil. It is true that the shoring may fail, also, but the fact remains that the stresses in the soil have not been counteracted by sufficient resistance from the soil plus that from the bracing. Failures along approximately circular surfaces can be expected unless local conditions produce another shape. A straight surface is frequently assumed for convenience.

In Figure 32, a form of analysis similar to that employed for slope stability is suggested. Use of equation (17) permits the establishment of a safety factor. The effect of heavy loads along the edge of the trench is indicated since the weight of the portion over the shear surface adds stress to that from the soil weight. Most of the problem arises because of the difficulties in predicting the stress, but more importantly, the resistance of the soil is hard to estimate accurately. This is essentially the same problem as has been discussed previously. With temporary openings, the need for accuracy is much more acute, because soil shear failures may require several hours to several days to develop. Some slopes may stand on a near-vertical face for several months before failing. Such occurrences are normally associated with delayed ground water movement, however.

Generally, estimates of the critical height for a given soil condition can be made, but whether the results are as good as those available from a truly competent construction man with experience with the materials of the area is debatable. Certainly the computed values would require some laboratory test data, unless a failure or cave-in is available for analysis on the basis described in the design discussions.

The resistance of the soil comes from friction (granular materials) and cohesion (fine-grained soils). Unless some "cohesion" from fines or from moisture films are present in sands, a vertical slope cannot be maintained. Thus, as a sand dries out, the apparent cohesion from the moisture film may be lost and failure in shear may occur.

The presence of flowing water, particularly from a granular deposit, is also a danger signal since the shearing resistance is lower than if free water were not present. However, failures associated with free-flowing water should occur almost immediately following the excavation. De-watering by pumping from holes drilled back of the slope can lower the water table and measurably increase the stability.

In excavating slopes rather than structural foundations, stability is the only serious consideration. Since the plans specify the angle, no problem traceable to construction should develop unless the slope is temporarily steepened. Since slope failures are normally classed as landslides, they are covered in a later section.

A general statement relative to the differences in behavior between natural and man-made soil deposits is of interest relative to slope excavation. Natural deposits of soil rarely have the shear strength available from a well-compacted soil. Notable exceptions are the indurated (dried-out) clays in ancient river valleys or glacial till plains. Except for this latter type of deposit, natural soils tend to be relatively loose with low shear strength. Therefore, the critical height for a given slope will be a great deal less for a natural deposit than for a compacted slope, or for an excavation in a compacted slope.

EMBANKMENTS

The major soil behavioral problem with embankments is settlement, although elements of both stability and permeability are involved on occasion. Generally, adequate compaction for stability is not too difficult to achieve. Permeability, when encountered in earth dams, may be

quite important. Both of these latter two factors can be reasonably well predicted by laboratory tests if samples of the soil are made available. On the other hand, settlement predictions are much more difficult to obtain in as precise a manner. The inability to determine the probable settlement, particularly as to its rate, is the most likely reason for any tendency to over-design by requiring excessive compaction.

From the behavioral viewpoint, the shearing resistance of a given soil tends to increase with an increase in the unit weight. Therefore, a stronger material is available. With regard to settlement, greater unit weights mean fewer voids, and obviously, less chance for settlement.

The role of the design engineer should be to evaluate the shearing resistance and settlement potential and design the embankment accordingly. However, it has become common pratice to specify the greatest possible compaction under the assumption that the densities so obtained are needed.

The question of possible over-design with reference to embankment compaction has been of very recent vintage. Only since the advent of bigger and better compaction equipment has such a possibility been recognized. The consideration of over-design can best be approached by the analogy to concrete. The highest grade of concrete is not used except where the strength is required and included in the design of the members. Thus, soil need not with certainty be compacted to as tight and as strong a material as the equipment will produce. In highway embankments, the two factors of stability and settlement are present. For many years, compaction to one standard was followed. No great difficulties appeared to develop due to stability, except in landslide areas, and these were not frequently associated with failures to compact the fill. The question as to settlement of a compacted fill has never been satisfactorily analyzed, but one might conclude that standard compaction was producing fills that did not settle too much within themselves. As to foundation densification under the load, certainly the best of compacted fill cannot prevent such settlement.

It should be noted, however, that when high-type pavements must by necessity be placed directly on the completed fill, greater compaction may well be warranted. Since the discussion here deals principally with soil behavior, arguments relative to cost-savings produced by varying compaction requirements may not be pertinent. However, as construction forces become familiar with the relative ease of producing standard vs. special compaction, some reflection in costs might be forthcoming.

While the compaction of the bulk of the embankments might or might not be adequate under standard compaction, it is obvious that improvement of subgrades by greater compaction will reduce the pavement requirements. Therefore, the efforts to achieve stronger subgrades resulted in heavier rollers and "special" compaction standards. For certain earth dams, also, reduction of permeability is worth extra compaction costs. However, it is the writer's opinion that the tendency toward requiring special compaction without due regard to the extra costs and questionable gains has developed without complete analysis. The importance of these matters in this discussion is that the reasons for compaction requirements must relate to stability or to settlement. Therefore, construction specifications should reflect analyses of the influence of compaction on the two behavioral items.

A vital consideration in embankment construction is the foundation upon which it is to be placed. In the section dealing with design, mention was made of the stability problem. From the settlement viewpoint, two influences of the foundation are critical. For one, the settlement due to densification of the foundation by the weight of the fill will quite frequently be greater than settlement within the fill itself. Second, the ability to compact the first 12 to 24 inches of a fill may be seriously handicapped by a soft foundation since you cannot compact well against a yielding surface. This latter problem is discussed more fully in a subsequent section on "Soft Ground." As to the division of total settlement into that from beneath and that from within, good observations and continued research is needed. The amount and the rate of embankment settlement is needed in order to obtain maximum economy.

For many highway, airport, and earth dam projects, a source of borrow is required. Generally, any non-organic soil can be used in embankments unless the design has specifically accounted for certain strength properties. In such cases, soils that will develop the needed shear strength are necessary.

The purpose for which the borrow is to be used will frequently control. For example, if a high degree of impermeability is required, clay or a long-graded sandy clay will be needed. Also, if the fills are quite high, soils with greater shearing resistance may permit steeper side slopes and a corresponding savings in borrow requirements.

Embankment problems are further discussed under the following two headings: (1) Laboratory and Field Tests and (2) Factors Affecting Compaction.

Laboratory and Field Tests

In order to establish a basis for determining the adequacy of compaction, the moisture-density (Proctor) test is used. The test was designed for the sole purpose of compaction control, and has little value for other purposes. Some empirical guides to strength and to classification are based on the test values but no consistently accurate and reliable strength index can be so determined. The standard test was originally designed to reflect the abilities of compaction equipment available in the early 1930's. Therefore, under "Standard" Specification, present day equipment should achieve such densities without undue effort. Essentially, the laboratory test determines how dense the soil should be and consists of compacting a soil into a metal mold in three layers, using a standard size hammer, and a specified number of blows. Details of the procedure are covered in ASTM and AASHO Standards and will not be repeated here. The unit weight of the compacted soil is computed under the specified amount of effort, and the moisture content is measured. The first trial is conducted with the soil relatively dry. For the second trial water is added, the same compaction used, and the unit weight and moisture content re-determined. A third, fourth and fifth trial compaction is made, each time adding water until the unit weight is less than for the preceding trial. Typical results are shown in the upper curves of Figure 33 which are designated as the "wet" curve.

The unit weights thus computed are converted to the unit weight (dry) as given in equation (3) as W_s/V. The importance of the unit weight (dry) is that the best measure of compaction is the amount of soil particles in a cubic foot—not the greatest weight of soil plus water. The greatest unit weight (dry) value is termed the *maximum density* while the moisture content at which that density was achieved is termed the *optimum moisture content*. One of the confusing elements

of the moisture-density test is the apparent contradiction that the soil compacted at a higher moisture content is stronger or better than the dry one. Actually, there is no contradiction, for at the time the tests are run, the drier condition will show greater strength. *It is the inability to maintain the dry condition that causes the problem.* If it were possible to do so, there would be no reason to add water to get compaction. However, water will migrate through most soil embankments and the more void space, the more room there is for water. In effect, the desire for greater density is in reality a desire to keep the ultimate capability for holding water to a minimum.

Another factor related to the compaction is that if the effort is increased, greater maximum densities can be obtained. Furthermore, this higher density will be achieved using less water. The term "maximum" applies, then, to only one type of compactive effort—increasing the effort increases the maximum density, whereas decreasing the effort lowers the maximum density. The so-called "special" compaction standard laboratory procedures, established and available in ASTM and AASHO Standards, employ greater compactive efforts as can be seen in Figure 33. The implications of the preceding influence of compactive effort is important from a construction viewpoint. Presumably, if heavier equipment is available than existed in the early 1930's, then standard maximum density can be achieved with less water and less coverages than if the lighter equipment were used.

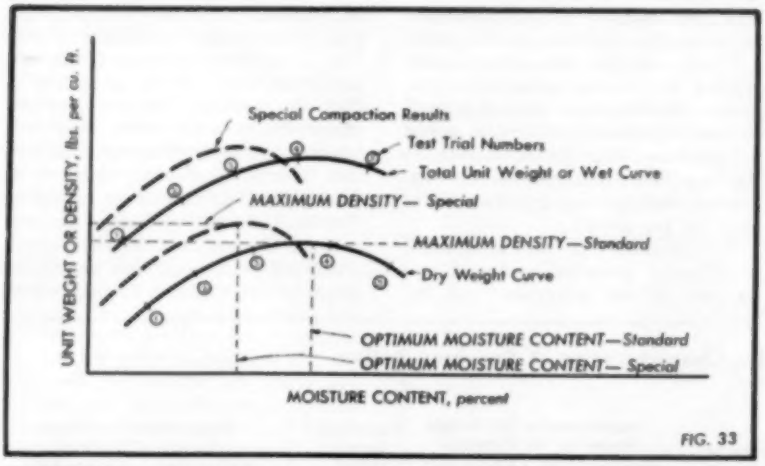


FIG. 33

● **RESULTS of the Moisture-Density test form a guide for compaction control.**

The role of water in obtaining greater compaction is usually considered to be one of lubrication. The reason for the fall-off after maximum density is attributed to the fact that free water develops, and since the laboratory and field effort is applied practically instantaneously, the water prevents the particles from getting closer together.

On construction, the actual unit weight obtained by the equipment is determined by a "field density test" which is for the sole purpose of comparison with laboratory data for checking on adherence to the specifications. Note that the field density tests do not determine how much density should be obtained. Generally, specifications do not require that field density be equal to the laboratory value unless very poor soils are involved. The comparison between field and laboratory density is on the basis of the "percent of compaction." The percent compaction is obtained from the ratio of the field unit weight (dry) with the maximum density. The percent of compaction that is required may range between 90 and 100 percent that of the maximum density.

The field density test is a simple one, consisting of digging out a portion of the compacted material, weighing all that is removed from the hole, and determining the volume of the hole. The soil is then dried and the dry weight (W_s) divided by the volume of the hole (V) gives the unit weight (dry). If the unit weight (dry) is below the value permitted in the specifications, the material must be scarified and recompacted.

Factors Affecting Compaction

In embankment compaction, the following factors influence the unit weight obtained and consequently the strength and compressibility of the compacted soil:

(a) Type of material to be compacted;
(b) type of equipment;
(c) amount of moisture present during compaction;
(d) depth of the lift being compacted; and
(e) number of passes of the equipment.

The method utilized for compaction is frequently controlled by the specifications, particularly those concerned with methods rather than simply end results. Since the adequacy of the compaction can be determined and evaluated by measuring the unit weight-in-place and comparing these values with the maximum density, there appears to be little necessity for concern as to methods used. Further, tests on each lift prior to the construction of the next are not critical since tube samples can be taken and the density determined at any time subsequent to the compaction.

Certainly the most important reason for end-result specifications is the opportunity afforded to the construction forces to obtain the most efficient operation. In the following, it will be noted that many techniques and procedures will produce satisfactory densities. The most economical procedure can vary tremendously from one location to another, in terms of weather, and with the type of equipment available.

The type of material to be incorporated into the embankment is quite critical from the viewpoint of equipment used, particularly if one considers the two extreme types of soils —granular and cohesive. With granular, rocky material short on fines, vibration is the most effective way of achieving high densities. To some extent gross weight plus vibration will be a good combination. Water will not be too critical unless long-graded sandy or gravelly material is involved. For one-sized sand or gravel, water can be used if a "flooding" technique is followed but water will not help much with granular materials and conventional construction equipment. On the other hand clays will not be affected much by vibration, are responsive to some added weight, and are critically affected by the amount of moisture present. In fact, the Proctor test was established for cohesive materials. A maximum peak (Figure 33) on the curve of unit-weight vs. moisture content does not develop for granular materials and a so-called "relative density" is sometimes used for

control purposes. Relative density has not been generally accepted by the highway industry due to test difficulties, but the term refers to the ratio between the density obtained and the maximum obtainable in the laboratory by vibration, rodding, or other techniques.

In lieu of vibrating equipment, heavy dozers, pneumatic rollers, or other equipment that tends to produce some vibrating action will be superior to pure weight. On the other hand, clays can be most readily compacted with the "sheepsfoot" or tamping type of roller. In Table 6, the various types of compacting equipment are listed along with the type of material most suited to the equipment when used for highway embankment construction.

An important principle in compaction is that *any equipment can be used to achieve the required result as long as a certain minimal weight is available.* However, to obtain adequate densities, the thickness of the lift, the number of passes, and the moisture content must be varied to meet the situation. Guides to these variations are given in Table 6. The principles are easy to understand—as the compactive effort is lowered the allowable thickness of the lift decreases and the number of passes tend to increase. For heavier compactive efforts, thicker lifts, fewer passes, and lower moisture contents can achieve the specified density. Smooth wheel rollers for earth embankments are the least effective of all compactors, but satisfactory results can be obtained if the lift thickness is reduced.

Clays can be more uniformly compacted with a sheepsfoot since the teeth penetrate to some depth and tend to compact "from the bottom up." In recent years, use of super-compactors has become prevalent. Even though these do not penetrate as do the sheepsfoot rollers, the over-all average density of the layer can meet specifications in many instances. However, it should be noted that uniform density should not be expected with super compactors unless thinner than necessary lifts are used. The upper inches of a lift will tend to greater compaction than that specified while the lower few inches will tend to be at or below the requirement. Thus, when uniformity as well as average density is a factor (as it may be for earth dams) there is some question as to the adequacy of super-compactors with clays.

In evaluating methods of compaction only two criteria are needed—is the final density adequate and is the required degree of uniformity produced? Recalling that stability is rarely a problem and that the question of settlement is difficult to evaluate, continued insistence for the greatest density obtainable may or may not be the best economics. The only clear case for the best density possible is one in which relatively high fills are involved and the pavement (structure) will be placed on the fill immediately following construction. Even a six-month time period is a sufficient delay to assure little continued settlement. However, very little data are available as to the continuation of settlement after compaction to various percentages of the maximum density.

SUBGRADES

The term subgrades will refer herein to structural slabs and foundations, as well as to pavements. The role of the subgrade has been described previously under "Pavement Design" and the compaction problems are not unlike those for embankments. Both stability and settlement are involved. For structures, the concern is principally settlement, and uniformity of subgrade support to minimize differential settlement is important. However, since the effective depth of the subgrade may be several feet or even much greater, little can be normally accomplished insofar as structural subgrade densification is concerned. Where significant deflection could be produced due to conditions in the top foot (particularly true for sewer lines) some compactive efforts may be required.

For pavement or slab subgrades, a different situation exists. Compaction of the subgrade will increase the strength properties. As a result, less strength is required in the slab. The principle was discussed under "Pavement Design" and is related to the fact that the more resistant the subgrade is to shear, the less added resistance must be contributed by the pavement. Therefore, costs of compacting the subgrade need be compared to cost of pavement or slab material. Almost invariably the costs of achieving added strength in the subgrade is considerably less than would be the cost of additional pavement. Probably of equal importance is the fact that settlement of the subgrade is also of concern. Higher densities mean lower void ratios and less opportunity for settlement. Further, the lateral shear that develops is also reduced by conditions of higher density and lower moisture content.

From the construction viewpoint, then, full encouragement should be given to the ultimate in compaction

Table 6—Characteristics of Standard Rollers

Roller Type	Range of Total Weight (Tons)	Range of Pressure	Recommended lift Height (loose-in.) for 8 passes*		Operating Speed (mph)	Most suitable soil type for use of highway embankment construction
			Heavier Units	Lighter Units		
Three Wheel	5-20	60-500 lbs./in.	6-8	4-6	1-5	Granular, particularly where crushing is desirable
Tandem-Two Axle	3-16	60-500 lbs./in.	6-8	4-6	1-5	"
Tandem-Three Axle	12-20	60-500 lbs./in.	6-8	4-6	1-5	"
Pneumatic	3-12	20- 30 p.s.i.	6-8	4-6	1-15	Sandy, sand-clay, and silts
Super-Compactors	20-50	50- 90 p.s.i.	12-24	12-18	5-10	All types
Sheepsfoot	2-20	100-800 p.s.i.	8-12	6-9	5-10	Clays and silty-clays

*A pass is defined as a single application of a given roller.

of the subgrade, and the importance of such compaction to the pavement and slab performance should be fully understood.

SPECIAL PROBLEMS

Of the many problems that arise during construction, none occur with more frequency than does that of starting an embankment across soft ground. Almost as universal are the difficulties encountered when bad foundations for sewer lines exist. In some areas, landslides are particularly troublesome. Problems encountered in soil stabilization are also of interest. In the following, these special problems will be discussed in light of the inherent requirements for stability and settlement.

Soft Ground

In almost every part of the world, nature has produced deposits of organic silts and clays. These deposits are normally located in recent stream valleys or in glacial lake bed areas. Unquestionably they offer the most universally troublesome problem that highway construction encounters. Frequently, the design engineers will be aware of the areas and specific methods for dealing with the problem are included in the plans. Sometimes they are missed, and occasionally borderline conditions are not recognized until after construction has been initiated. The discussion included under "Sand Drains" presents pertinent considerations. For embankments on soft ground, both stability and settlement are of concern. However, both have been treated in the sand-drain discussion and need not be repeated here beyond recognizing their underlying presence.

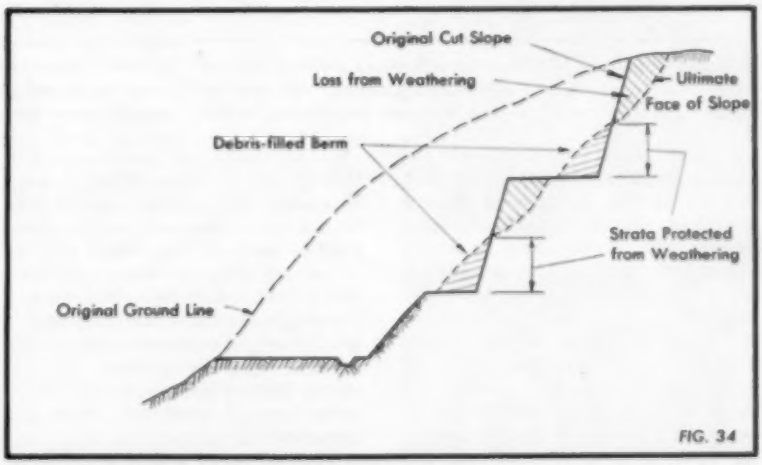
The problems in construction center around the starting of the fill and the handling of wet soils. The conventional method of stripping the topsoil prior to starting the fill may not be feasible in many instances. In fact, churning up the area with dozers may only make matters worse. A useful technique to be recommended where specifications permit is the placement of a two- to three-foot granular, free-draining material directly over the organic topsoil without bothering to strip the surface material. End-dumping procedures should also be followed, and dozers used to spread the granular material ahead. No equipment should be permitted on the soft ground. Such a procedure provides an immediately available firm layer for starting the fill. The procedure may or may not have too general an application since shallow soil deposits can be more economically handled by excavation, and very deep deposits require special attention. However, the temerity to risk settlement by not removing the organic, soft material has not permitted such construction even when feasible. Unquestionably, some settlement will occur under the aforementioned procedure. However, if the placement of the pavement is at least one year away, and the problems of stability and deeper-seated settlement are handled, few difficulties should be anticipated. It should be kept in mind that the special procedures discussed here are for starting a conventional fill so that the settlement of only a very thin layer, 6 to 12 inches of the top soil is involved.

The compaction of wet silts is also encountered in areas of soft ground. Apparently due to a minor organic content, the materials will not dry out readily. Furthermore, in attempting to compact them, an adequate density cannot be achieved easily. On occasion the density is obtained, but the surface ruts, rolls, and heaves under construction traffic, giving the impression of inadequate compaction. In reality, having achieved a specified density value, any difficulty that arises can only mean that for the standard (or special) density, the material is too weak to withstand the construction loads without shear failures. Corrections for such problems are varied, but are apparent by recognizing that low shear strength is the basic cause. At subgrade elevation such materials will require more or stronger pavement, replacement with a stronger material, or some combination. Within the embankment, such layers may produce no difficulties since the shear requirements for slope stability are much less severe than for soil layers immediately under the load.

Landslides

The subject of landslides is so extensive that only a relatively brief mention is possible here. In principle, all soil shear problems that occur on slopes can be classed as landslides. However, this discussion will be restricted to slope failures on natural and not man-made slopes. Rock slides are also important but are not specifically included. In principle, the major differences lie in the location and nature of the shear surface. In order to prevent rock falls (due to weathering) from being a hazard or producing debris in the ditchline, construction of berms is an increasingly used slope design technique. Since rock is capable of withstanding tension or to state in soils terms, has considerable cohesion, rock falls are tension failures produced by the reduction of the tensile strength (by climatic elements) or a fatigue-type of failure.

Berms to protect against rock fall are designed under two philosophies. One involves cutting the slopes sufficiently flat so as to minimize or eliminate debris on the berms. The second cuts the slope considerably.

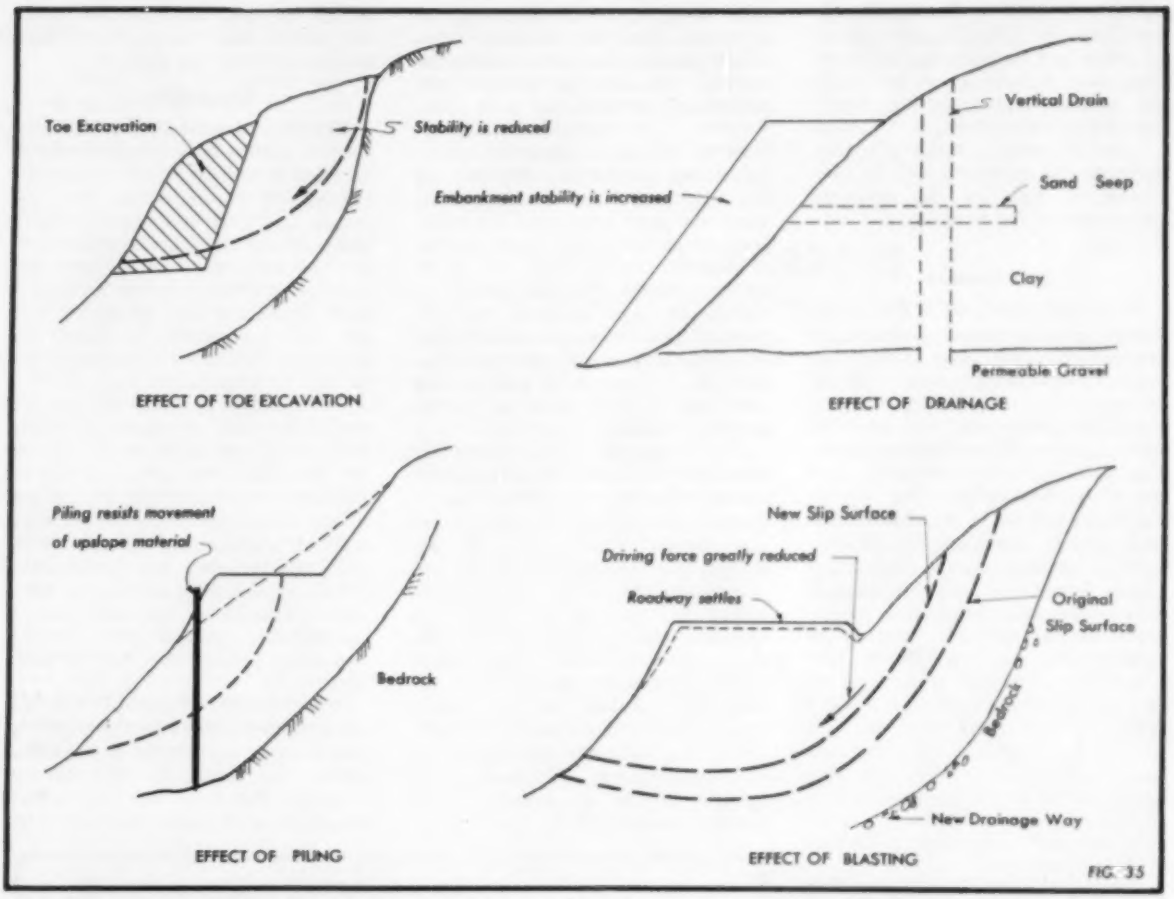


● **IN THIS ROCK SLOPE design, debris is collected on a series of berms. In this position it protects the slope above from further weathering. Note that the berm should slope slightly towards the road to provide drainage of water to the ditch.**

steeper so that material falls to the berm, is collected there, and protects the rock above the berm from further attack by the elements. The theory of the second method is shown in Figure 34. Where the second philosophy is utilized it is essential that no debris be removed unless it is spilling over the bench upon which it was designed to rest.

tween debris and bedrock will equal that within the debris itself the drier condition will be superior.

One of the problems associated with rock slope design is that the angle to which a rock will weather is highly indeterminate. Therefore, regardless of which of the two theories is used, an accurate estimate of slope angle is not possible. The preceding expression is true regardless of whether "mud flow" types of failures occur or whether large blocks are involved. Unfortunately, conditions surrounding rapid, flow-types of movements immediately prior to failure are difficult to analyze. There appears to be a very sudden reduction in shearing resistance following the initial failure.



● **CONSTRUCTION WORK which will affect stability includes toe excavation, which may produce movement by reducing the frictional component of shear; drainage installation, which reduces weight and improves shearing resistance; piling to resist movement of upslope material; and blasting to decrease weight above the shear surface and provide a drainage path.**

Also of interest is the fact that the berms for the second theory should be sloped *towards* the road slightly (15:1), rather than away from the road. This provides drainage for the water flowing down the slope, and minimizes the possibility of the debris sliding off the bench. The immediate reaction might be that the berm-surface provides a ready-made shear surface. However, as debris collects the drainage along the berm will be blocked, and the same shear surfaces could develop. Since for comparable moisture contents the shearing resistance between debris and bedrock will equal that within the debris itself the drier condition will be superior.

One of the problems associated with rock slope design is that the angle to which a rock will weather is highly indeterminate. Therefore, regardless of which of the two theories is used, an accurate estimate of slope angle is not possible. The theory of debris filled berms, however is more economical. This is true because steeper, permanent parts of the slopes are assured on the protected portions, while the unprotected areas assume the angle produced by the climatic conditions. The appearance of the detritus-filled berms may not be very impressive, however, until some type of vegetative cover accumulates.

The failure of soil slopes follows the principles expressed in equation (16); i.e. the shearing stress exceeds the shearing resistance. The preceding expression is true regardless of whether "mud flow" types of failures occur or whether large blocks are involved. Unfortunately, conditions surrounding rapid, flow-types of movements immediately prior to failure are difficult to analyze. There appears to be a very sudden reduction in shearing resistance following the initial failure.

In analyzing natural slopes on a rational basis two factors are particularly troublesome: one is obtaining a reliable estimate of the shear surface; and the second is determining the shearing resistance along that surface. A common misconception is that a well defined shear surface must exist prior to failure. This may or may not be true. In clays, even if such a surface exists, essentially the same shearing resistance will most frequently exist with or without such a surface. From a descriptive viewpoint or to understand the type of action that

should be undertaken, however, the underlying principle that the resistance must be increased or the stress decreased is still applicable.

While the following discussion on landslides is included here in a section dealing with construction, it should be emphasized that good design procedures will eliminate many failures before they develop. Further, preventing the occurrence is of significant value for the slope may never regain some of the inherent structural value lost through tension cracks and fissures within the slide mass.

Several instances are pictured in Figure 35 for purposes of illustration. Frequently, toe excavation of a slope is considered necessary or desirable. The removal of the mass at the toe reduces in a major way the total frictional component of shear, and thus brings about the failure. Expediency frequently produces the demand for the removal of the material which has moved downward. However, such activity only compounds the problem. Sometimes a slope is so near equilibrium that any disruption will produce movement. By starting the excavation at the top, the most severe unbalancing of forces does not occur until after there has been a reduction in the major forces producing the stress; i.e. the part of the mass overlying the steepest portion of the shear surface is the largest source of driving force. For clarification of this preceding statement, and referring to Figure 23, the stress develops due to the component of the weight that is parallel to the slip-surface. Thus, the weight at the top of the mass produces the greatest part of the shear stress.

The role of drainage is of special interest since the technique is frequently recommended for landslide correction. The value of drainage can be to reduce weight, improve shearing resistance by lowering the moisture content of the soil, or by reducing the buoyant effect of the water which results in an increase of the frictional part of the shearing resistance. The first two influences cannot have a major or rapid influence on stability, particularly if an impermeable clay is involved. Time is required for the influence of a well-placed drain to be felt. The reduction of the buoyant force of the water is more likely to account for any relatively rapid improvement of stability. On the other hand, clays have a very low value of ϕ and the buoyant force would not appear to influence a source of major resistance. Since many landslides come to rest under a temporary equilibrium, it is probable that the major influence of drainage is a long-range one. The value of drainage, in any event, will be commensurate with the ability to place the drain so as to intercept or tap the major source of water.

Piling and walls constitute frequently used corrective methods. Obviously, the devices add resistance to that available from the soil. Since soils cannot resist tension, the added resistance must be placed at the toe or near the structure to be protected.

One of the controversial and less easy corrections to reduce to soil behavior principles is blasting. The procedure consists of disrupting the shear surface, normally by lifting rock fragments up and through that surface. The values derived from blasting are twofold. One, the changing of the shear surface reduces the weight acting on the surface, thus reducing the stress. Second, a more open, permeable mass exists below the shear surface and provides a drainage path out of the mass toward the toe. However, slow settlement of the mass is probable, and a gradual silting (or blocking) of the drainage is also quite likely. Such methods have been successful in special cases, but are rarely recommended for a long-range technique.

There are numerous other examples that could be cited relative to the prevention and correction of landslides. In every instance, it is possible to consider treatment in terms of decreasing stress or increasing resistance. For major problems, a specialist may well be needed. On smaller ones, the principles of the previous discussion can be applied to increase the stability.

Sewer Construction

Several of the basic features related to problems in sewer construction such as cave-ins, dewatering, and compaction of the soil immediately under the pipe have already been discussed. The main problems in sewer line construction are stability of the trench slopes and differential settlement of the pipe. Nothing more need be said here relative to the bracing requirements. As to pipe settlement, since the weight of the pipe flowing full may still be less than the original weight of the soil, troubles may not arise due to downward settlement. On the other hand, if the pipe is placed below the water table, some precautions may be needed to prevent "negative" settlement or uplift.

Settlement may develop, however, due to the point-load nature of the pipe in place. Therefore, the use of a granular layer or a concrete encased base is not uncommon particularly when soft ground is encountered.

Soil Stabilization

The use of soil stabilization has application in deep foundations, landslide masses, and highway pavements. In all cases, the shearing resistance of the material is improved. For deep foundations the value may well be that of reducing settlement since this also results from the improvement of the strength properties.

Most of the problems in soil stabilization are ones of construction or high material costs. The construction problem is one of mixing, particularly if clays are involved. Use of stabilization for deep foundations and landslide problems are highly complex and should receive the attention of specialists.

For pavements, stabilization is becoming increasingly more important. The reasons lie in the very excuse for stabilization—more economical use of local materials. Stabilization should not be considered unless a significant savings can be achieved over other types of pavements. This is because the results are less certain unless trained personnel are available.

Four commonly used methods will cover the different types of stabilization possible; namely, cement, bituminous, mechanical, and lime. The function of the stabilization is the same regardless of the admixture in

● **FIGURE 36. Sewer construction in Orange County, California. Gravel bed provides a stable support for the pipe.**

that an increase in strength is obtained in terms of shearing resistance or flexural strength.

The most rigid of the four types is soil-cement. In a sense, weak concrete is produced. The increasing use of sand and gravel for the aggregate has led to a type of construction called "cement treated base." The major problem with soil-cement lies in the difficulties of intimately mixing the cement with clays. However, using relatively high cement contents, some excellent results have been achieved. Use of select granular borrow to reduce cement content and to improve mixing efficiency is normally recommended if such borrow is readily available.

Bituminous stabilization is not generally recommended for soils unless at least 50 percent of the particles are sand-size or larger. Basically, the problem is one of mixing and of preventing the clay balls from softening if water enters the mass. The end product of bituminous stabilization of granular materials is basically a weak bituminous concrete or road mix. Increased resistance to shear and waterproofing are two of the advantages that accrue. The increased resistance arises from the cohesion-type of property added to the granular material.

Mechanical stabilization is merely the development of a long-graded material. The gradation is so designed as to have a minimum void ratio after compaction. A certain amount of "apparent" cohesion develops due principally to aggregate interlock. Hygroscopic materials such as rock salt and calcium chloride add to the durability of such pavements by causing moisture to be retained, thus adding to the strength of the interlock. While no significant flexural strength is achieved, the shearing resistance can be appreciable.

Lime stabilization acts differently than the other additives in that it may be most effective in clays through a reduction in the plasticity properties of the material. By reducing the plasticity, less shear displacement occurs for a specific stress level. Over long periods, pozzolanic action may also develop and some rigidity benefits realized. However, the reduction of plasticity is the major source of immediate value. As to how general lime is successful in reducing plasticity has not been completely established. Where effective, however, strength may be added to subgrades which in turn can reduce pavement requirements.

This article concludes the series on "Principles of Soil Engineering." Reprints in booklet form are being prepared and will be available soon.

CHANGING TO City Wide Water Metering

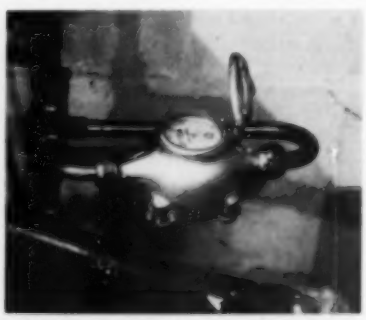
EDMUND T. CLOONAN,
Superintendent, Water Department,
Kingston, New York

MAGNETIC drive meters are helping our water system to ease the transition to universal water metering. Better than 85 percent of our system has been converted over the past two years, and we have little trouble keeping the meters in top operating condition. The only two parts of a magnetic drive meter that operate in water are an oscillating piston and a roller which guides it. These we will maintain, but they can be handled by our present facilities.

Another favorable feature is the frost protection provided by a breakable bottom plate. The internal construction and lack of gearing in this type of meter will allow ice to form without damaging the works as long as the ice has expansion room. If a meter is to be installed where it will be subjected to freezing temperatures—and we have cold weather here—we can purchase it with a cast iron bottom plate that will break to allow the ice to expand without damaging any working parts.

Selection of the meter was only part of the program. Years of discussion on the advisability of universal metering had preceded this move. As early as 1925, our engineering consultants, Clinton Bogert Engineers, had advocated this course as a means of limiting waste of water.

The Water Board headed by Howard S. Pangburn passed the final resolution early in the summer of 1957, and events of that summer proved to ourselves and the local citizens that this was the proper step. Heavy use of water for lawn sprinkling and car washing, plus simple waste through leaks, pushed our supply and filtering systems very close to their designed limits. Our pressure filter plant has a nominal capacity of 8 mgd. During the summer on days of peak delivery we used 8.13 mgd. The heavy summer use and a fall drought drained our storage reservoir to a dangerously low level. An intense publicity campaign enlisted the support of the populace and reduced consumption enough to see us through the crisis, but it was apparent we were acting at the right time.



● **WATER metering program called for installing 500 to 600 units per month. Two-man crews did the work.**

At the start of this program only 1000 of the 7,500 water service points in the city were metered; now, less than a year and a half later we are nearly 85 percent metered and will shortly undertake the clean-up phase to complete the program.

We purchased 6,400 Rockwell SR meters in the fall of 1957, and assigned two full-time crews of two men each and one part-time crew to the job. They have installed 500 to 600 meters a month, despite the

● **WATER Works foreman, Fred Ernst, center, dispatches two-man crew on meter installation job. Despite interruptions average installation time is 0.8 hour per meter.**

fact that they must take time out periodically to read the meters already installed. Many times, where the house occupant has been at home and the piping is adequate, meters have been installed in less than 15 minutes. Even with travel time and other lost motion counted in, the average installation time has been 0.8 hour for a two-man crew.

The city was divided into six zones for installation purposes and these same zones have been maintained for billing and accounting procedures under the new system. Edwin Wetterhahn, our cashier, has a complete accounting system to keep track of the condition of each service point in the system. He also keeps an inventory file of the history of each meter.

We have established a new rate schedule for use with the metered system and are studying it closely to be certain that it meets our needs and the needs of our customers.

We are sure the per capita use of water is dropping as the people become used to the idea that they determine the size of their own bills. They seem pleased that they can control it; in many cases, the bills of individual consumers have gone down considerably. Peak days of consumption after the meter program began in 1958 have been 5.6 mgd and 6.33 mgd.

The drop in consumption will save us from the immediate necessity of a costly expansion of our facilities. As the city grows and legitimate needs increase we will be satisfied to know that any expansion will be to provide for increased use, not increased waste.

● **WHEN installation has been made, installer takes initial reading. A new rate schedule has been adopted. Peak consumption has been reduced about 25 percent.**

on the ALASKA HIGHWAY

W. H. SPINDLER,
Editor, Technical Publications,
Armco Drainage & Metal Products, Inc.

WHAT IS the record of the bridges and culverts on the Alaska Highway after 16 years of service? What have permafrost and muskeg foundation materials done to these structures?

Offhand, the winter temperature extremes along the Highway are not much lower than in the northern tier of states in the U. S., and the ground elevations above sea level are appreciably less. The maximum roadway elevation at Summit Lake is less than 4500 ft. But the underlying soils make a difference, at least structurally. Testifying to this is the suspension bridge over the Peace River, 35 miles north of Mile Zero on the Alaska Highway.

Built in a period of nine months in 1943, mostly from materials salvaged from the "Galloping Gertie" of Tacoma Narrows, this 2130-ft. structure was the longest on the Highway. The north anchorage pier was founded on soils that proved inadequate, with the result that the pier gave way in October, 1957, and led to failure of the bridge. Replacement is now underway with a deck-truss steel bridge of cantilever construction. Completion is expected early in 1960. Precedent for this new structure is a similar one about 2½ miles upstream that carries the new line extension of the Pacific Great Eastern Railway from near Dawson Creek to Fort St. John (Mile 48). This latter bridge has a temporary plank floor and serves as an alternating one-way detour for highway traffic. On the 9-mile detour is a Bailey bridge crossing over Pine River, a tributary to the Peace River.

Parallel with the new bridge under construction, a few hundred feet downstream, is a new pipe line river crossing from the natural gas field on the north side to tanks on the south side and en route to Vancouver, B. C.

The only remaining suspension bridge on the Alaska Highway is one over the Liard River at Mile 495.8 in British Columbia. It is 1143 ft. long.

During the past six years, permanent steel truss bridges have replaced the earlier pile trestles. Included in one over Nisutlin Bay, (Mile 803.5), the longest water span on the highway, 1917 ft. long. Nearby is the Nisutlin Bay Trading Post, a "pioneer" store established here in 1928, and an old Indian village.

● **MULTI-PLATE culvert at Mile 1280 is 9½ ft. in diameter and is a recent installation. Note man on end of pipe.**

Over Slim's River, (Mile 1059.8), a new steel bridge crosses a glacial moraine at the head or south end of Kluane Lake. The Donjek River bridge (Mile 1132.8) is a new 8-span through truss structure, 1617 ft. long, completed at a cost of $2.5 million.

Numerous small timber bridges were part of the 1943 building program. Some of them have been replaced with steel I-beam structures. Others have been and are continuing to be replaced by full-width embankments over large metal pipe and pipe-arch culverts. These Armco Multi-Plate type structures consist of round or elliptical pipe (5 percent vertical elongation) from 6 to 13½ ft. in diameter, or of pipe-arches as large as 16-ft. span by 11-ft. rise. The result has been reduced maintenance at these locations.

End protection of these culverts consists either of boulders, riprap or light-weight steel sheeting driven as a cutoff wall and as a straight headwall or wingwalls.

Some of these larger culvert installations have been in connection with the more winding stretches of the highway built in haste in 1942-43. Many such relocations will probably be considered before much paving of the highway is done in Canada. (The 300-mile portion in Alaska is now paved, as of late 1959). This would seem wiser than paving and perpetuating the poor alignment and hazards found in many areas.

Turning now to the smaller culvert installations, the Alaska Highway has been a vast proving ground for the structures placed in 1943. Drainage of the pioneer or tote road, built by the U. S. Army En-

gineers in 1942, consisted largely of box culverts made of unpeeled native logs.

These early structures were replaced in 1943 by the U. S. and Canadian contractors who, under the direction of the Bureau of Public Roads, converted the tote road to a passable military highway in one short construction season. Creosoted wood stave pipe up to 48-in. diameter and laminated wood box culverts from 4 ft. by 4 ft. to 10 ft. by 10 ft. were used in some of the earliest reconstruction. They were readily available and they have served well.

A large share of the culvert structures were replaced in 1943 with corrugated metal pipes in diameters 18 to 60 inches. These were not of the conventional long riveted sections but for transportation reasons were of the nestable type. Two-foot long top and bottom half-circle sections were stitched or bolted together to form a pipe on the job. These flexible structures of galvanized metal have shown resistance to poor foundation soils, permafrost, frost heaving, icing and swift flow of mountain streams. Even under shallow fills, they have withstood the pounding of heavy traffic without signs of distress.

The importance of adequate drainage, the need for getting surface water across and away from the roadway is evident to any engineer. Many of the culverts carry a continuous swift flow. On the other hand, there are swampy, muskeg areas where the culverts may serve as an equalizer, with water standing in them most of the time. Also there are gravelly areas where the runoff is quick and short.

● **BITUMINOUS curb is placed along sections of the highway to guide surface water to outlets and protect shoulders and embankments from erosion. Mile 1252.**

Annual rainfall along the route of the highway on the leeward side of the Rocky Mountains is for the most part less than average (probably 15 to 30 inches per year).

Maintenance forces of the Bureau of Public Roads on the 300 miles in Alaska, and those of the Northwest Highway System with headquarters at Whitehorse, Yukon Territory, on the 1220 miles in Canada, are confronted with the need for keeping the culverts and small bridges clear and the channel open at both ends.

They spend a great deal of effort in periodically cleaning out the channel for 25 to 75 ft. at each end, using a small 'dozer or scraper to shape the flat ditch bottom. One problem is to keep the patrolman on the blade grader from covering the ends of the culvert under shallow fills.

● **MULTI-PLATE pipe arch, 12 ft. 6 ins. by 7 ft. 11 ins. replaced an old wooden bridge at Mile 767. Many culverts along the highway carry a continuous swift flow.**

Winter maintenance of culverts is a terrific headache. When temperatures drop to zero and well below that, culverts and ditches tend to "glacier" and fill with ice. For the milder cases, culverts are cleared occasionally by steam piping equipment. For more severe cases, a drum of oil is set up at one end of the culvert with a continuously burning flame to keep the structure de-iced.

Another problem occurs at the so-called "gravel fans"—wide, fan-shaped areas of boulders and coarse gravel rolling from steep canyons and delta areas. Swift mountain streams are fickle and do not hesitate to change their course during a single or repeated storms. Dikes and other artificial channel controls are used to help guide these wild streams.

Areas particularly plagued by these gravel fans are along Kluane Lake, Mile 1066 to 1076, and the Toad River and Muncho Lake areas from Mile 410 to 465. Long gravel dikes help to funnel the water toward the bridge or culvert under the highway, instead of letting the stream choose its own crossing place.

Finally there is the matter of controlling ground water in roadway cuts and under fills. Gravel fills and bases vary from shallow to deep, but permafrost in the subsoil has a way of defying stabilization when subject to thawing. Subdrainage pipes and interceptor drains have not been tried on any systematic basis. However, there is a need for research on this subject if the Alaska Highway is to be relieved of excessive heaving and subsequent differential settlement.

Water and ice are still two of the highway engineers' worst headaches.

Water Quality Evaluation

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Austin, Texas

This article is based on a paper presented at the Texas Section, ASCE, Spring Meeting, 1959.

THE TERM "water quality evaluation" implies that there is water available for some anticipated use. Such studies generally encompass three objectives: Identification as to amount and location; determination of the natural and man-made factors which cause degradation; and formulation of measures to adjust the quality to a particular need. The location and availability of water in Texas have been established, but the yield may be rather indefinite, while quality estimates are certainly lacking. Furthermore, for any one future date it is virtually impossible to take a major stream and place a statistically significant figure on future water quality. Accordingly, long-range water quality evaluations should be made only after: 1) A comprehensive data collection program has been established whereby the extent and sources of both natural and man-made pollutants can be determined; 2) an overall future water re-use picture has been developed so that the influence of domestic and industrial effluents can be considered; and 3) a means is found mathematically to treat the tremendous volume of data that must be processed before engineering judgment can be exercised.

Water Quality Objectives

The need for the improvement of water quality should be obvious since the available limited supply must meet the increased needs of modern trends toward urban development and industrialization. A recent survey of water utilities in the United States shows that 20 percent are deficient in supply even though there is currently a $2.6 billion water works construction backlog (1). The future expenditures must be even greater because many water utilities will need to install treatment facilities. The total cost of new water works construction needed between now and 1975 is estimated to be more than $20 billion (2). By 1975 almost 150 million people of an estimated 209 million will obtain their water from public water supplies. The per capita need will be at least 200 gallons daily.

What does all this predicted development mean in terms of water quality? In some areas, if present and future quality studies are not initiated along with quantity evaluations, a region may find itself in about the same position as if it were without sufficient quantity available to meet the demands, regardless of quality. Also, industrialization of certain areas will not develop to the extent which natural resources might permit.

Data Collection Programs

Historical quality data are as important to the engineer as past rainfall and runoff records. The ultimate purpose in quality data evaluation would be to answer the following questions:

1) What will be the probable quality of water at any selected point in a basin for any set of basin operations which may include the development of resources?

2) What decisions can be made as to the treatment required to meet a given water-quality criterion knowing the risk of making an error?

Just as in the case of runoff, water-quality data for any one place are time dependent. However, in quality studies many more variables enter into the picture. For this reason it is very important to determine as soon as possible what the quality of the water is and to correlate it with runoff, seasonal usage, dilution as affected by used water, specific conductance, and possibly other factors such as chlorides and sulfates.

A few comprehensive water quality surveys are being conducted in Texas and nearby states. These are an important beginning for this area, but in terms of ultimate statistical evaluations the data need supplementing. The Water Pollution Control Division of the Texas State Health Department has taken a great stride in pinpointing areas of pollution. Over 200 sampling stations are contributing bimonthly data on BOD and ions normally of interest to water users. Also, included in this survey is the collection of base radioactivity data. (3) The Public Health Service, in its water quality studies of the Arkansas and Red River Basins, has consolidated a great deal of documented information and has supplemented existing information with field studies for the Red River Basin. (4) The Geological Survey also collects and compiles a vast amount of very useful data. Several State agencies other than the Health Department record information, particularly relating to chlorides. However, none of these agencies can provide information to an industrial firm that would enable it to estimate with any statistical assurance that the quality will be above or below a certain level only "x" days per year, or what the quality might be if certain industrial and other river basin projects were put into operation.

Future Possibilities

It is almost a foregone conclusion that comprehensive water quality programs of real significance will be based on the development of mathematical handling techniques and fast electronic computer programs. Yet, before a differential equation can be written or input data fed into a machine, certain correlation schemes and time-dependent equations must be worked out.

It is suggested then that the major need in future long-range water quality studies is that a hard look be taken at what information is needed and exactly how the data might be applied. The information must certainly include the important aspects of water re-use as well as the natural factors which affect water quality.

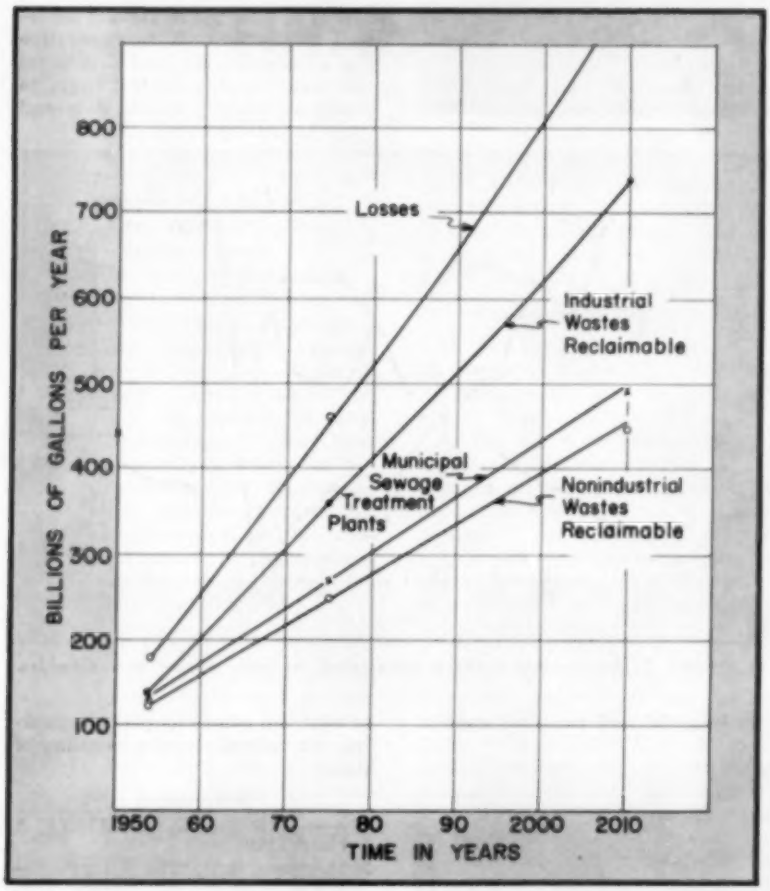
Examples are given herewith of some future waste-water statistics

and computational aids for solving water re-use problems. These demonstrate methods of estimating amounts of waste-waters and depict the ways by which large volumes of data can be processed. First, quantity and quality estimates must be made; and second, computational aids must be developed for handling the data.

Availability of Used Water. Undoubtedly there will develop in the future many plans for estimating the extent of waste water production. One such method may be based on a refinement of a report recently made available by the Bureau of Reclamation. (5) This is based on a programmed development of all the natural resources, including water. To support the estimates of future water demands and waste-water it is necessary to assume that water of the required quantity and quality will be available to develop fully the natural resources.

The project area encompassed by the exploratory report included 97 of the 254 counties of Texas. The project generally covers the eastern and Gulf Coast sections of Texas. To facilitate ease in handling the data, the project area was divided into basic sub-areas, usually centered around one of the larger towns.

The paths of water from supply-to usage-to wastage and finally to disposal and return flow were traced categorically. The supply was listed as to source and type, i.e., surface and well water of private or public origin. Water usage was either domestic or industrial. The waste waters were grouped into categories which included combined municipal and industrial sewage, separate waste systems going directly to the streams, and losses. The actual used water was obtained by a projection of this information.



● **FIGURE 1. Anticipated waste-water distribution, with amounts reclaimable.**

Municipal sewage treatment plants handled about 135 billion gallons in 1954, and it is expected that the quantity will be about 275 billion gallons per year by 1975. Reclaimable industrial waste waters not put through municipal plants in 1954 amounted to about 122 billion gallons per year. The total reclaimable water produced by this project area in 1954 was estimated to be 810 thousand acre feet. Likewise the 1975 estimate is 1.8 million acre feet. These wastes represent a useful and fairly large amount of water. However, these waters also carry with them increased quantities of organic matter, phosphates, detergents, other dissolved inorganics and perhaps other deleterious substances. In some cases there will be physical changes in temperature, color and turbidity; whereas in other cases pH changes become apparent.

Stream Pollution

The influence of sewage on streams is illustrated by a study of the San Antonio River. Under the influence of phosphate and nitrogen the diurnal dissolved oxygen cycle has shown tremendous algal activity in the stream. This was observed when the flow in the stream was 150 cfs, and of this about 35 cfs was contributed by a fairly well-operated sewage treatment plant located 80 miles above the sampling point. Detergents were found to continue to exert their influence downstream. Anionics are difficult if not impossible to break via the biological cycle, the net result being that this water would present some taste and odor problems after chlorination, even if treated and diluted. The combined effects of treated sewage and brines from a relatively small oil field have shown a seven-fold increase in specific conductance. These are only three of the many examples which once again demonstrate the fact that future water planning must consider the extent of used-water dilution.

Computational Aids. Whatever the work that will be done regarding large-scale water-quality planning, it is certain to involve high-speed electronic computational techniques. The large number of "what if" problems regarding quality will require the compilation and correlation of tremendous quantities of data. Two brief examples help to demonstrate possible computing techniques which may be helpful.

The first case involves what might be a small segment of an overall basin complex. The problem posed is that of chloride buildup; namely, what is the extent of chloride buildup under various stream flows and basin operations? Figure 2 depicts a case where an industrial and municipal complex proposes to take water from a reservoir and in effect re-use some water during certain dry periods.

For this problem approximately 20 years of historical rainfall and

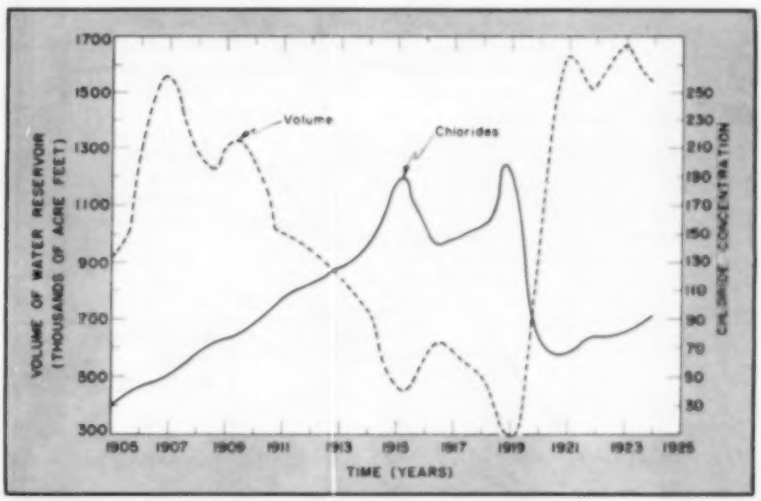
runoff records were used as a basis for evaluating reservoir yields. Other data included evaporation-transpiration rates from the stream, evaporation rates from the reservoir, irrigation uses, municipal consumptive losses and required downstream releases. The supply to the city was assumed to be 224,000 ac. ft./yr., and the downstream releases were established at a constant 30,000 ac. ft./yr. The fraction of the water returned to that of the total supplied to the municipality was based on historical rainfall and population indices and expressed in equation form. This method has been previously developed and reported (5). Evaporation from the reservoir was taken to be 5 ft./yr. The exposed water area was related to the reservoir volume by an exponential type equation.

The chloride balance was also established by using historical records. The chloride content of surface runoff and the ground water was about 30 mg/L while the increase in chloride between the drinking tap and the sewer was about 90 mg/L.

A mathematical model was developed using all inflow and outflow data with appropriate chloride build-up factors. The relationship between anticipated reservoir volume and chloride is shown in Fig. 4. For this model the chlorides increased to 195 mg/L before dilution reduced the concentration. It is this type of solution which can be duplicated many times with modern electronic computing facilities. It is also this type of information which can be used most effectively in answering the many "what if" questions concerning water quality.

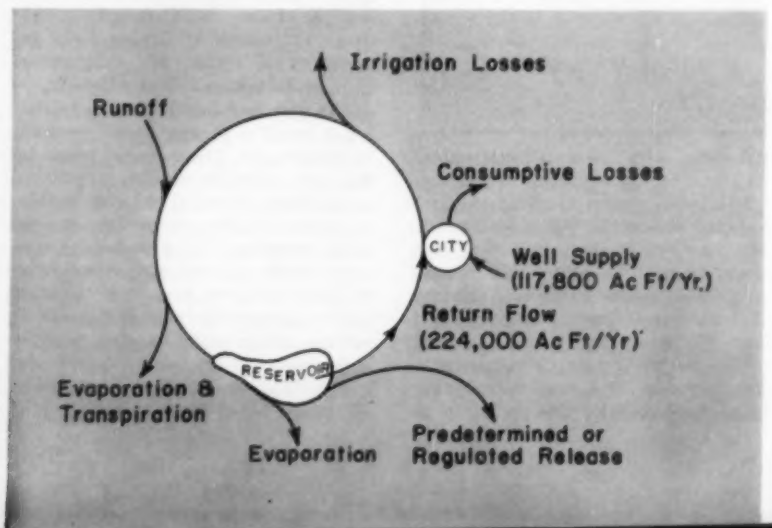
The longer and more involved the problem, the more suitable it is for machine solution. As an example, programs for routing streamflows for the entire Columbia and Kansas River Basins have been developed for use with an IBM 650 digital computer. In the former case, the procedure was developed primarily for forecasting streamflow in connection with day-to-day reservoir regulation. The program produces six hourly values of streamflow at more than 60 gaging stations and also provides forecasts for 41 sub-basin areas, 32 channel reaches and 7 major lake storage areas.

The next possible example for exploring potential water-quality has to do with developing some means of using the masses of historical data. This is difficult because the only measurements for most streams are daily specific conductance and runoff. Chloride, sulfates, etc., are usually not made on a daily basis. In some cases daily chloride samples have been collected, but actual determinations have been made on consolidated samples having similar specific conductance values. Consequently, an indirect correlation between specific conductance and contributing ions must be sought and appropriate equations developed.



● **FIGURE 3. Relationship between anticipated reservoir volume and chlorides.**

● **FIGURE 2. Typical recycle of water in an industrial and municipal complex.**



Summary

Unless effective steps are taken, water quality will decrease in time as a result of both natural and man-made pollutants. This quality reduction can come about and yet there would be no infraction of existing laws in their current interpretations.

A comprehensive data collection program is vitally needed. This data collection program should be planned so that modern computational techniques can be used most effectively. Much of the existing data is of little use in making statistical evaluations. It is imperative that all agencies involved with water and water quality control begin to obtain statistically usable data and to establish a uniform policy regarding the collection and processing of data.

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● BALTIMORE'S Back River Sewage Treatment Plant serves 1,240,000 population. Operation, which is financed by the annual sewerage service charge, amounts to 30 percent of the operating cost of the entire city sewerage system.

SEWERAGE CHARGES FINANCE SYSTEM OPERATIONS

C. E. KEEFER,
Sewerage Engineer,
and
RIMMA SKLAREVSKI,
Assistant Mechanical Engineer,
Bureau of Sewers,
Baltimore, Maryland

PRIOR TO 1959 the funds for operating and maintaining the sewerage system of Baltimore, a city of about 980,000, were obtained annually from the general tax levy. During the latter part of each year a budget, which included the various estimated items of expense for the following year, was prepared and approved. This budget and the budgets of the other city departments are used to determine the tax rate for the following year. The major source of revenue is the tax on real estate. This method of financing the operation of the sewerage system was in many cases not entirely equitable, because the service received was not commensurate with the tax collected. Partly to rectify this situation and partly to obtain additional revenue, studies were made to require property owners to pay a sewerage tax. As a result of these studies, an ordinance was approved in December, 1958, and became effective on January 1, 1959, requiring all property owners in Baltimore who discharge sewage or waste water into the sewerage system of the City to pay a sewerage tax. The amount of the tax is based on the amount of the bill for water. It is estimated that approximately $3,300,000 will have been collected from this source in 1959. As the cost of operating and maintaining the sewerage system amounts to about $2,600,000 a year, the money collected in excess of this amount can be used to pay the interest and the amortization on the outstanding sewer loans.

Provisions of Ordinance

1) The sewerage tax is levied on all properties that discharge sewage or waste water into the sewerage system of the city.

2) The tax is an annual one and is based on the water service available or on the quantity of water used. The amount of the tax is 50 percent of the water bill.

3) Where a property owner obtains a portion or all of the water he uses from a source other than the water supply system of the city, he is required to install at his own expense an approved meter for measuring the quantity of said water, and he is billed as though all of the water were obtained from the city.

4) Where a portion of the water is used for industrial or commercial purposes and is not discharged into the sewerage system, the quantity of water so used is excluded in determining the sewerage service charge.

5) Where bills remain unpaid, the city has the right to shut off the water until they are paid. The charges for sewerage service become a lien on the property of any person who fails to pay them.

The above-mentioned ordinance exempted hospitals, religious, charitable, educational, literary, fraternal and benevolent organizations from paying the sewerage tax. On June 25, 1959, this ordinance was repealed and a new ordinance was passed, which levied a sewerage charge and not a sewerage tax. The principal difference between the new and the old ordinance was that the above-mentioned organizations were no longer exempt from paying for sewerage service.

Charges For Service

As has been previously stated, the charge for sewerage service for each three months is 50 percent of the water bill. The property owner must pay the bill in full; otherwise he is subject to the penalties which have been previously mentioned.

In about 52 percent of the accounts the water bill is based on the quantity of water used by the property owner as determined by a water meter. The charge for water during each 3-month period is as follows: For the first 5,000 cu. ft. of water, $2.50 per 1,000 cu. ft.; for the next 45,000 cu. ft., $1.50 per 1,000; for over 50,000 cu. ft., $1.00 per 1,000.

The minimum charge for water for 3 months depends upon the size of the water meter. This minimum charge is $2.50 for a ⅝-in. meter and $485 for a 12-in. meter, and the minimum sewerage charge is 50 percent of the water bill.

Approximately 48 percent of the dwellings are not provided with water meters. In such cases the charge for water depends upon the width of the dwelling. The following are the charges for water for each 3-month period for some of the dwellings having different widths: 12 ft. or less, $10.00; over 19 ft., but not

over 22 ft., $33.00; over 30 ft., but not over 35 ft., $41.25; and over 40 ft., $48.75.

Special rates have been established where water meters are not used and where the building is used for business purposes.

Where water is used by a property owner for fire protection, the sewerage service charge is based on the actual quantity of water used for fire-fighting purposes, and there is no minimum service charge if water is not used. Approximately 0.5 percent of the water meters in the city are used to determine the quantity of water used for fire-fighting purposes.

Where water meters are provided, the average sewerage service charge is approximately $19.50 a year, and where a flat rate for water is levied, the charge is about $8 a year. The reason why the former charge is higher is that water meters are provided in commercial and industrial establishments where considerable quantities of water are often used.

Among about 237,000 accounts, 122,000 are on the basis of metered water supplied by the city; 113,000 are based on front footage; 500 on metered water for fire fighting; 1,000 on metered condensate from the local gas and electric company; and 10 from metered water from other than municipal supply.

One not unimportant advantage associated with levying a charge for sewerage service has been that it has alerted property owners to the wasteful use of water. One good illustration of this situation is that of a company that makes approximately 150 tons of ice a day. After the company made improvements at a cost of $2,000 that resulted in less water being used, it is estimated that the bill for water and sewerage service will be reduced by about $7,000 a year.

In general the implementing of the tax is not difficult. Every three months the water meter in the pipe serving each property is read. These readings are forwarded to the Bureau of Accounts and Disbursements, and the charges for sewerage service are included in the bills for water; these bills are mailed to each property owner, who makes payment to the Bureau of Receipts. An additional six or seven employees are required to do all the work associated with collecting the charge for sewerage service.

Exemptions

Many industrial and manufacturing plants use large quantities of water that do not discharge into the sewerage system. Among these are breweries, bakeries, power plants, and the manufacturers of ice; towing and lighterage companies using tug boats, railroad yards and the makers of soft drinks. In most instances there was no difficulty in installing the necessary water meters so that the water flowing to the sewers could be determined. In one case the quantity of water that entered into the product is obtained from the records of the quantity of product manufactured. This quantity is deducted from the total amount of water purchased from the City to determine the quantity discharging into the sewerage system.

The local gas and electric company has three steam generating plants that sell steam for heating buildings and for other purposes in the mercantile and business section of the city. Most of this steam discharges into the sewerage system as condensate. The foregoing company is not billed for the quantity of this condensate flowing into the sewers; however, their customers are. About one-third of the steam that is generated discharges as condensate from the company's drippots into the sewerage system. The sewerage charge for handling this condensate is about $12,000 a year.

There are many cases where property owners have their own sewage-treatment facilities, the effluent from which discharges into the ground or into the harbor. These property owners are not required to pay a sewerage charge. There are other instances where the water used by a property owner discharges into a stream which receives the drainage from the storm water sewers of the city. Streams in this category are considered a part of the sewerage system of the city, and property owners who discharge waste water into such a stream are required to pay a sewerage charge.

In case any property owner should disagree with any decision pertaining to the provisions of the ordinance, which established a charge for sewerage service, he has the right to bring the matter in dispute before the Board of Municipal and Zoning Appeals for review. This Board has the authority to reverse or affirm any decision or order that may have been given.

Summary

The adoption of a charge to cover the cost of operating and maintaining the sewerage system of Baltimore city is considered the most equitable way of financing this municipal facility. The extent of the service rendered and the amount of the charge for it bear a direct relationship to each other. In general there have been very few objections to imposing a sewerage charge, perhaps because it has not been excessive. The expense of collecting the charge has been quite nominal in view of the amount of money collected. One most valid reason for imposing a sewerage charge such as the one adopted in Baltimore is that the payments by property owners for sewerage service are in proportion to the service rendered.

Acknowledgements — The sewerage system is operated and controlled by the Bureau of Sewers, which is one of ten bureaus comprising the Department of Public Works, of which Bernard L. Werner is the Director. Dr. Abel Wolman is consultant to the department.

Mechanical Waste Collection Reduces Costs Markedly

With a population of about 33,000, Valdosta, Ga., is accomplishing a saving of about $20,000 per year in refuse collection. This was accomplished by utilizing 131 LoDal waste containers and a 20-yd. Hydro E-Z Pack garbage unit equipped with a 1-yard front end loader. The waste containers are of 1 to 4-cu. yd. capacity. These are spotted at strategic points throughout the city where substantial amounts of refuse are produced. Mostly, the containers are used in business and commercial areas. At stated intervals, depending on the size of the container and the volume of refuse being produced, the truck picks up the containers and empties them into the compacting body. As much as 100 cu. yds. of loose refuse can be carried by the Hydro E-Z Pack unit, thus greatly reducing the haulage costs to the disposal site.

As a result of this installation, which was completed last August, work formerly requiring three trucks and nine men is now performed by one truck, one driver and one helper. The labor savings alone aggregate approximately $20,000 per year. Cost of the installation was about $45,000 which will be repaid from savings within three years.

MODERNIZING
SAN RAFAEL'S STREET LIGHTING

NORRIS M. RAWLES,
Supervisor of Public Works,
San Rafael, California

A SMALL, bustling but growing city, San Rafael, California, has approximately 18,000 population. It is the County seat of Marin County situated adjacent to San Francisco Bay. It is the shopping center of the County and as such, has a busy main (Fourth) street, frequently thronged with people from outlying areas. It is the sort of a business community that is certain to generate a demand for modern street illumination. Friday nights the merchants in the downtown areas keep their stores and shops open until 9:30 o'clock as a convenience to those who are unable to shop during regular store hours.

The Mayor and City Council, a progressive and forthright body, directed the Public Works Department and the City Manager to make a survey of the entire City and prepare a recommendation for modernizing the City's ancient street lighting system. The result of that survey was the adoption of a "Master Street Lighting Plan" by the City Council in February, 1958. This plan, to be fully completed in a three-year period, was developed in close cooperation with Dan Andersen, City Manager, James Barnes, Senior Illumination Engineer and Mark Jensen, Commercial Lighting Representative of the local office of the Pacific Gas and Electric Company.

Trial Demonstration

A trial demonstration block between D and E Streets was originally installed by various manufacturers and the Pacific Gas and Electric Company, at no cost to the City. These were the 62,000 lumen fixtures finally approved by this office. This particular block was practically burned out in a disastrous fire in July, 1957.

To date, some eighteen months later, the lighting on approximately 60 percent of the residential and related areas is completed with a minimum of 2500-lumen mercury vapor lights. The entire length of Fourth Street, a distance of 1.1 miles, is completed with 62,000-lumen silver-white mercury vapor lights with an average staggered spacing of 57 feet in the downtown area. The lights are installed on metal poles 32 feet in height, delivering about eight foot-candles of light. The poles were manufactured by Union Metal Manufacturing Company, the luminaires by Westinghouse Electric Corporation and the lamps by Sylvania Electric Products, Inc.

All of the new lights were installed on Sundays to eliminate inconvenience to the public. Results of lighting on Fourth Street illustrate what a downtown shopping street can do to modernize and answer the regional shopping center "threat." According to the best available information, I am told, this lighting is second only to State Street in Chicago, Illinois.

On a portion of Fourth Street (from E Street Westerly), a single wire overhead was used. An engineering study of the existing underground system indicated many deficiencies and rather than have a costly replacement program, the single wire overhead was decided upon. Actually the appearance is not objectionable nor in fact is it noticed by the average merchant, pedestrian or motorist.

The total cost of the capital improvement program for all installations was assumed by the Pacific Gas and Electric Company without any capital outlay to the City. The City pays a set monthly service rate which includes all maintenance and replacements with the Company owning all the lights.

Public Approval

The City Council feels this public money was well spent. Favorable reports have been received not only from the merchants, but from the general taxpayers as well. The City's Police Department is most enthusiastic over the improved light as indicated by the following abstract from a letter from C. J. Chiesa, Chief of Police:

● **NEW 62,000-lumen lights on Fourth St., looking east from A street. The entire length of Fourth St., 1.1 miles, is served by 62,000-lumen lights. Average staggered spacing is 57 ft. in downtown area and lights are mounted on 32-ft. metal poles.**

The following improvements have been noted by this department resulting from the new mercury-vapor lighting installation:

1. Increased lighting facilities decreased accidents, as compared to darkened streets.

2. The light tends to decrease the number of burglaries, prowlers, etc., which normally thrive in the darkness.

3. Women who heretofore were afraid to walk along darkened streets now may take advantage of the improved lighting.

4. The police units find it much to their advantage in patrolling these well lighted areas in detecting or recognizing any wrong doing.

THE AUTOMATED OASIS

WALTER A. WEBSTER,
Gordon Herkenhoff & Associates,
Albuquerque, New Mexico

THE ONLY source of water for decades for Albuquerque, New Mexico, has been a series of deep-water wells that by 1954, had spread over an area of more than 28 square miles and included sources separated by distances of ten miles and more. There were 34 wells in all. To cut down the burdensome operating costs of such a system, the city's electorate approved a $500,000 bond issue to finance the automation of their water supply, which at that time provided some 67 million gallons a day for 160,000 people.

Today, six years later, this same system includes 46 wells, pumps nearly 93 million gallons of water a day to more than 230,000 people but costs $80,000 less to operate each year than its previous counterpart.

In addition to these 46 wells, the system includes a series of six settling basins, 14 booster stations and 10 storage reservoirs. Tying them all together is a network of pipes and wires controlled by a maze of intricate meters and other measuring devices channeled through a master control panel at the Santa Barbara Pump Station, centrally located in the heart of the city.

Level transmitters, located in each of the storage reservoirs on both the east and west mesas overlooking the city, "wire" data on the quantity at each site to this nerve center where it is indicated visually on the master control panel. This intelligence is then relayed to each of the fourteen booster stations, where pumps are automatically engaged to satisfy pre-set level requirements. The individual wells are automatically operated by level indicators in their respective settling tanks, which furnish suction storage for the booster pumps.

Each of the 46 wells is equipped with a Sparling Mainline meter—most are either 12 or 14-inch units. All are equipped with a Sparling Type 215 indicator-totalizer-recorder, supplemented by totalizers between the wells and the settling basins. Each booster station is also equipped with a Sparling Mainline meter, measuring the flow from each site. The use of one totalizing record for all wells and booster stations provides an up-to-the-minute tabulation of all flows without the necessity of obtaining readings from each individual instrument.

Master Control Panel

Records of these two flows—the total from the well fields and from the booster stations—are transmitted over a single pair of wires to the nerve center at the Santa Barbara Pump Station, along with the booster station suction and discharge pressures, reservoir and settling basin levels, and data as to which pumps are operating and which are not. This intelligence is displayed on the master control panel and fed through Veeder-Root counters to intricate data-logger equipment, complete with an automatic typewriter which prints pressure, flow and liquid level for each well field, booster station and reservoir. At the end of each 24-hour period, total flows are combined to give an automatic "read-out" of the total pumpage for the day.

During this 24 hours, however, periodic "read-outs" every thirty minutes provide strict control records of individual flows from the typewriter-data-logger combination. Maximum and minimum "norms" are pre-set for each point on the data-logger; should either of these points be exceeded, the typewriter shifts to print in red, an alarm is given and necessary investigation can be undertaken.

In addition to payroll savings of more than $80,000 a year, these central control facilities enable the city to realize more indefinite savings through minimizing the service equipment heretofore required. There are several "side" benefits to this automated installation, too.

For one thing, the factor of "human error" has been eliminated to a great extent, replaced by electronic protective devices that indicate malfunction at any point in the system almost immediately. Secondly, these central control facilities have enabled Albuquerque to expand its water distribution system several times without the usual increase in operating and service personnel.

In a city that is growing at the rate recorded in the Albuquerque census, this latter factor can be a vital one. Plans are already being made for major expansion within the next five years. Thanks to these central control facilities—and the unique measuring devices that make them possible—this expansion will be virtually painless financially and will provide water for a population expected to exceed 320,000 by 1970.

Others Responsible for Engineering This System

System Engineering and Design:

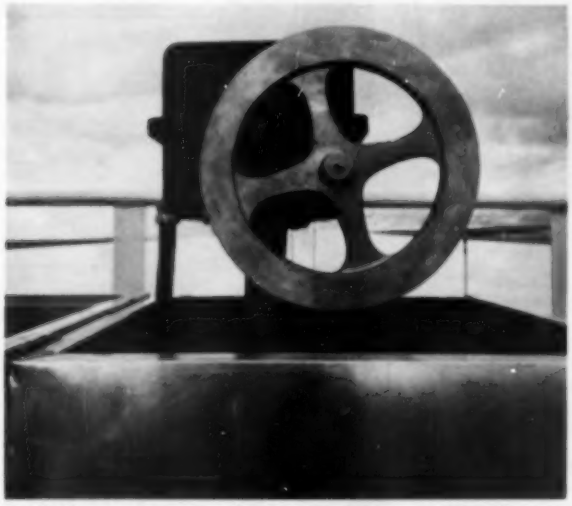
Goble and Sampson, Inc., Denver, Colorado
Sparton Control Corporation, Jackson, Michigan
Central Telemetering Control Co., San Gabriel, California
Hammarlund Manufacturing Co., New York, New York

Installation:

Reynolds Electrical and Engineering Co., Inc., Albuquerque, New Mexico

● **MASTER** control panel, shown here in part, graphically displays pump operations, reservoir levels, flow data and pressures from more than 70 units of the system, scattered over 28 sq. mi.

● **BOOSTER** control panel which indicates by light signals the operating condition of four pumps and by alarms problematic situations. Reservoir level and discharge pressure are shown.



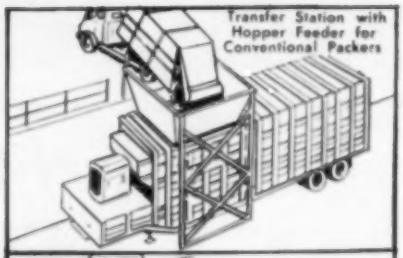
● **FLOAT** and tape mechanism for detection of the level in one of the reservoirs. This is tied to telemeter transmitter.

● **DATA** logger automatically types level, pressure and flow information on demand or at intervals as described in the text.

● **STATION** discharge flows are measured by Sparling Mainline meters and the data transmitted to the master control panel.

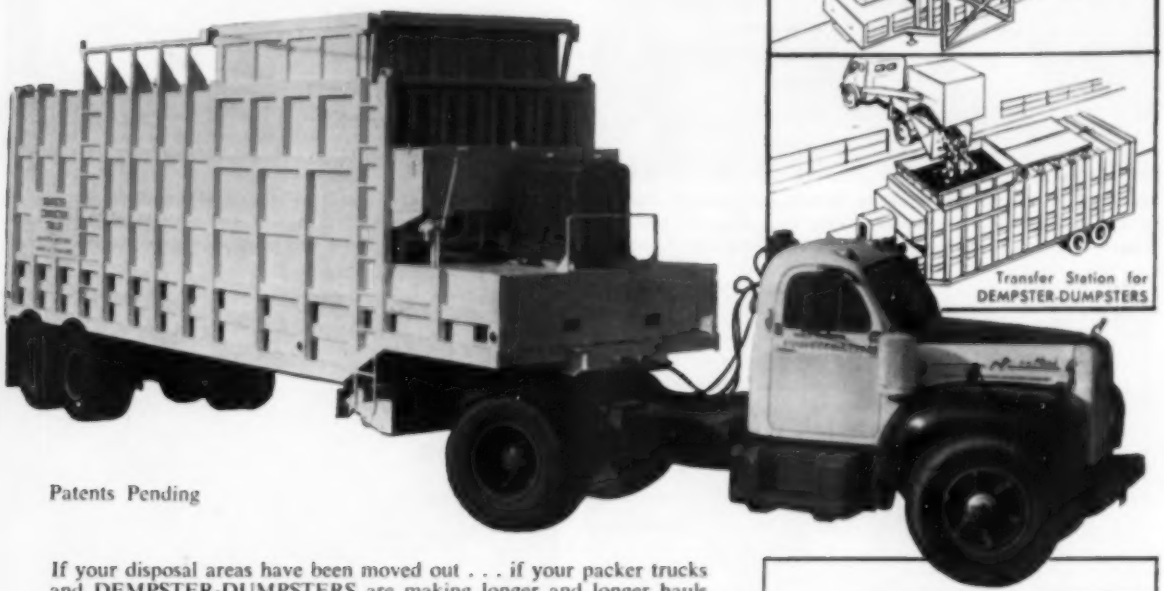
New DEMPSTER Compaction Trailer Hauls Up To 200 yds. of Loose Refuse

Giant Hopper Holds Contents of 16 Cu. Yd. Conventional Packer Truck



Transfer Station with Hopper Feeder for Conventional Packers

Transfer Station for DEMPSTER-DUMPSTERS



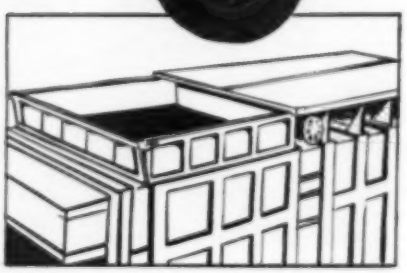
Patents Pending

If your disposal areas have been moved out . . . if your packer trucks and DEMPSTER-DUMPSTERS are making longer and longer hauls . . . you can cut your costs to the bone with the new DEMPSTER Compaction Trailer. This portable transfer station can be placed beneath a ramp or bank in a central location. Then your trucks travel only blocks instead of miles. The big hopper itself holds the contents of a 16-yard packer truck.

One of the several cities using this new trailer stands to save over $32,000 in the first year of operation of only one unit.

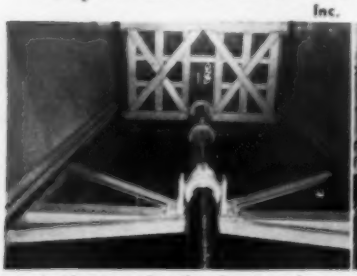
The DEMPSTER Compaction Trailer is all hydraulic, and has its own power plant. Both the 42-yard and 53-yard models deliver 60,000 lbs. hydraulic pressure to the face of the packer plate, enabling users to get (depending on the density of the material) 160 to 200 cu. yds. of loose refuse per trip.

For complete information, send for the free eight-page brochure that describes this new development.



The rolling hopper cover illustrated above increases the capacity of the trailer and prevents refuse scattering.

Dept. PW-4 DEMPSTER BROTHERS, Knoxville 17, Tenn.
Inc.



Inside view of trailer showing telescopic packer head cylinder that delivers pressure of 60,000 pounds.

Typical load of refuse being ejected by the packer plate. No tilting of the trailer is necessary.

To: Dempster Brothers, Dept. PW-4
Knoxville 17, Tennessee

Please Send Brochure on New DEMPSTER Compaction Trailer

Name _____ Title _____

Firm _____

Address _____

City _____ State _____

NEWS BULLETINS

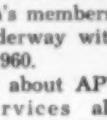
AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

APWA Launches Membership Drive: 5,000 Set As Goal for 1960

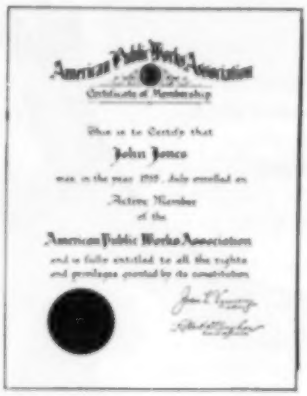
Chicago, Ill.—The American Public Works Association's membership campaign is now underway with a goal of 5,000 set for 1960.

A brochure telling about APWA and its helpful services along with an application for membership has been sent to all persons receiving PUBLIC WORKS magazine. If you are not already a member we hope you will take this opportunity to check into the services and privileges that APWA membership will bring you. If you are a member we hope you will acquaint others with the Association and use the application blank to sign up a new member.

One of the Association's objectives is to bring about a greater appreciation of the importance of public works officials and to enhance their prestige as professional engineers and administrators. One way in which you can help to achieve this goal is to display your membership certificate and wear your APWA emblem. As each new applicant becomes a member he is presented with a Certificate of Membership (8½ x 11) printed in gold and black and notarized with a red seal. The certificate states that the person enrolled is fully entitled to all rights and privileges granted by the Association's Constitution.



Membership pin is gold with a blue background


American Public Works Association
Certificate of Membership
This is to Certify that
John Jones
was in the year 1960 duly enrolled as
Active Member
of the
American Public Works Association
and is fully entitled to all the rights
and privileges granted by its constitution

The emblem is available to APWA members for $2.00 from the Headquarters Office.

Jean L. Vincenz, director of public works, San Diego County, California, and president of the Association, in a recent letter to all members stated, "Those of us who have been a part of the Association for a number of years feel that we have profited greatly from our membership. The monthly News Letter with its current coverage of happenings in the public works field, the publishing of books such as *Street Cleaning Practice* and *Refuse Collection Practice*, the local chapter meetings, the inquiry service, the Research Foundation—all help to make the public works official better informed and help to make his job an easier one. Only through growth can APWA increase its many services to meet the challenge of tomorrow and in this way help its members to cope with the increasing demands that population growth and urbanization place upon them."

Each individual member is an important part of the present campaign and can have a part in the attainment of the 1960 goal—a total membership of over 5,000 — by acquainting others with the objectives and services of the Association. For further information write to the Headquarters Office, 1313 East 60th Street, Chicago, Illinois.

APWA Board of Directors Approves Record Budget

Chicago, Ill.—At a recent midwinter meeting in Chicago the Board of Directors of the American Public Works Association adopted a record budget of $170,400 to help carry out many of the new projects planned for 1960. President Jean L. Vincenz called the Board's attention to the extraordinarily rapid growth of the Association in the last ten years. Executive Director Robert D. Bugher, in his annual statistical report, showed that more new members (830) enrolled in the Association in 1959 than in any other year in the history of the Association.

OFFICERS: Jean L. Vincenz, San Diego, Calif., *President;* Frederick W. Crane, Buffalo, N. Y., *Vice President.* REGIONAL DIRECTORS: (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Texas; (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; W. A. Bowes, Portland, Ore.; (term ending 1962) Paul R. Screvane, New York, N. Y.; Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D. *Immediate Past President,* Wm. D. Hurst, Winnipeg, Manitoba. Robert D. Bugher, *Exec. Director.*

An expanded public relations program for APWA, designed to bring about a greater appreciation of the importance of public works officials was also approved by the Board.

The Board authorized the appointment of a Committee on Transportation and a Committee on International Relations to facilitate contacts and the exchange of information on public works activities throughout the world. APWA President Vincenz was designated as the Association's official representative to the Eighth Inter-American Municipal Congress to be held in San Diego, California, October 16-22, 1960.

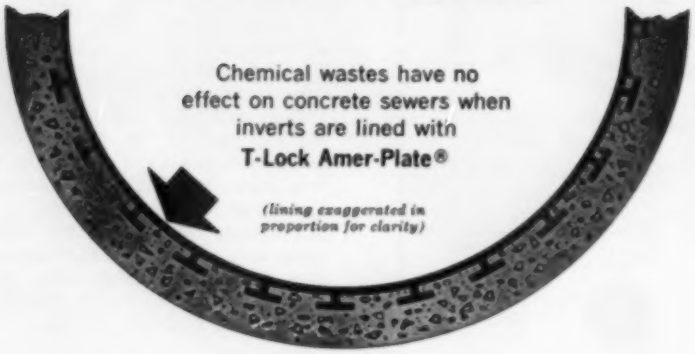
Regarding the 1960 Public Works Congress and Equipment Show scheduled in New York August 14-17, it was agreed that the Congress would officially open at noon on Sunday, August 14, and that no technical sessions would be scheduled on the morning of the third day, Tuesday, August 16. The registration fees for the 1960 Congress were set as follows: members $15.00; non-members $20.00; ladies $10.00. These fees will include tickets to the Get-Acquainted Party, and other social events exclusive of the annual dinner. A special one-day registration fee of $3.00 was also established which will not include tickets to any of the scheduled entertainment functions. Commissioner Paul R. Screvane, General Chairman of the Congress & Equipment Show, discussed plans for the meeting and reviewed the organization and functions of the Local Committee. Four cities were selected for consideration as possible sites for the 1963 Public Works Congress and Equipment Show. They are: Detroit, Cincinnati, Cleveland and San Francisco. The final selection will be made at the next meeting of the Board of Directors on August 13, 1960, in New York City.

A proposal by President Vincenz to establish a "President's Plaque" which would be awarded annually to the chapter making the greatest advance in terms of growth and accomplishment was enthusiastically adopted. The Board also authorized the appointment of a Committee to set up standards governing the award.

The President's re-appointment of Samuel S. Baxter, Philadelphia, Pa., and Don Bloodgood of West Lafayette, Indiana, and the appointment of William D. Hurst of Winnipeg, Canada, to three-year terms on the Board of Trustees of the APWA Research Foundation were approved along with other committee appointments which will be announced later.

Other action taken by the Board included the establishment of a Committee on Membership Fees and Services which will give particular attention to the fees and privileges extended to public agency and sustaining members of the APWA. The Committee on Rules Governing Local Chapters, headed by Vice-President Frederick Crane, indicated that it is making a thorough study and will submit specific recommendations for the Board's consideration at its next meeting. The recipient of the 1960 Harry S. Swearingen Award and the Board approved nominee for Honorary Membership will be announced at the Association's annual business meeting. The Board granted Life Membership to Mark B. Owen of Indianapolis, Ind., and to George Elliott of Baltimore, Md., in recognition of outstanding service to the Association as provided for in Section 6, Article III, of the Constitution; and authorized the issuance of special membership certificates to all Life Members of the Association. Permission was granted in response to a request from a Life Member to continue payment of annual service fees on a voluntary basis with the under-

How to Protect Concrete Sewers from Chemical Wastes


Chemical wastes have no effect on concrete sewers when inverts are lined with T-Lock Amer-Plate®
(lining exaggerated in proportion for clarity)

T-Lock Amer-Plate is a high polymer PVC sheet, easily cast into pipes, tunnels and structures to form a partial or complete 360° protective lining. Used in inverts, it permanently protects concrete from corrosive chemical effluents. In arch areas, it positively stops oxidized H_2S corrosion. T-Lock is also highly abrasion resistant; impartial tests show that it abrades at only 1/70th the rate of concrete.

The fact that T-Lock ends erosion and corrosion problems in industrial and municipal sewer systems is attested to by more than five million square feet now in use. Write for complete data on this maintenance-saving lining before designing your next sewer.

Applicators strategically located throughout U. S. and Canada

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118

PLAN *Low-Cost* BRUSH DISPOSAL-

PLAN ON A FITCHBURG CHIPPER

The exclusive Spring-Activated Feed Plate of the Fitchburg Chipper assures smooth, efficient, SAFE operation. This built-in engineering development, which makes trouble-free operation possible, has been patented.

FAST... ECONOMICAL...

...SAFE

Plan on *low-cost* disposal of trimmed branches, whether it's for a tree company, utility, highway department, a city, or a park department—plan on getting a Fitchburg Chipper.

This well-engineered and rugged machine turns brush into easy-to-dispose-of chips, at very low cost. Only the Fitchburg Chipper has an exclusive, patented Feed Plate which automatically adjusts for any size brush up to its rated capacity, making it possible to chip large or small material with ease.

This Spring-Activated Feed Plate reduces shock action and horse-power requirements since it permits chipping of larger size wood without extra power. The Feed Plate results in fast, efficient chipping without a heavy, cumbersome fly wheel. The smoother chipping action means lower maintenance, too, as well as greater crew safety.

This safety feature is important. "Because of the feed plate with its safety spring the men can't get hurt by any back-throw from the Chipper," explains the Superintendent, The Park and Shade Tree Commissions, Bridgeton, New Jersey.

Please send in the coupon for more information, and for copies of articles on chipping which appeared recently in leading publications. These feature articles describe five methods of brush disposal, and ten new ways to utilize "by-product" chips. Send for your copies, they are well worthwhile.

FITCHBURG ENGINEERING CORPORATION

Dept. PW-64
Fitchburg, Massachusetts

☐ Please send me important articles which describe 5 methods of brush disposal and 10 new ways to utilize brush chips.

☐ Please send more information on Fitchburg Chippers.

Name_____

Address_____

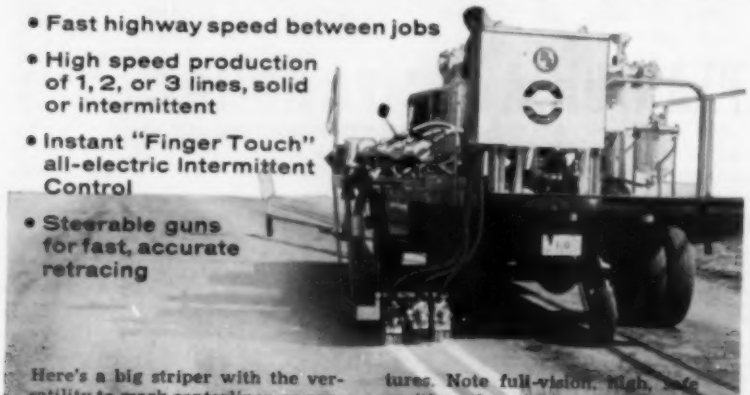
City_____ Zone____

State_____

FITCHBURG ENGINEERING CORPORATION FITCHBURG, MASS.

New (MB) Pacemaker 88 Line Marker mounts on Jeep or any light duty truck!

- Fast highway speed between jobs
- High speed production of 1, 2, or 3 lines, solid or intermittent
- Instant "Finger Touch" all-electric intermittent Control
- Steerable guns for fast, accurate retracing



Here's a big striper with the versatility to mark centerlines, or centerlines and edge stripes simultaneously. Fast and maneuverable, the low-cost M-B Pacemaker 88 includes an adjustable guide pole and caster wheel, air lift of outrigger guns, positive reflective bead control, plus many more exclusive features. Note full-vision, high, safe position of operator.

Send for information on the complete line of M-B markers, including custom designed heavy duty models specifically designed for your use that are comparable in price to "assembly line" machines. M-B Corp., New Holstein, Wis.

M-B CORPORATION
NEW HOLSTEIN WIS
PACKER BODIES • LINE MARKERS • SWEEPERS

WEMCO® the INCREDIBLE Torque-Flow pump

PUMPED!

Bailing wire, rags, bottles—even tin cans. The incredible Wemco Torque-Flow Pump handles any material with ease. Clogging is a thing of the past because of Wemco's recessed impeller, continuous, open passage. What will go in will come out. Send your pumping problem to the men of Wemco ... today!

reason: recessed impeller; continuous open passage (what will go in will come out)

WEMCO® a division of
Western Machinery Company
650 Fifth St., San Francisco, Calif.

standing that such receipts shall be credited to the APWA Research Foundation.

Plans for the 1960 membership campaign were presented and discussed by the Board of Directors. Each member will be encouraged to sponsor at least one new member during the next few months to boost the membership over the 5,000 mark. "The APWA Story" brochure and applications for membership will be mailed to non-member public works officials in conjunction with the promotion of attendance to the New York Congress and Equipment Show. The Sustaining Membership Committee, under the chairmanship of Milton Rosen of St. Paul, Minn., is also moving ahead with plans to extend the benefits of this type of membership to an increasing number of manufacturers of public works equipment materials and supplies. Larger municipalities will be invited to become Public Agency members of the Association and local chapters will supplement the entire campaign through their regular membership promotional activities.

North Carolina Chapter Holds Joint Meeting

Raleigh, N. C.—The North Carolina Chapter of the American Public Works Association held its annual meeting in conjunction with the 6th Annual Municipal Public Works Conference, February 17, in Raleigh, N. C. The chapter meeting and the conference were held at North Carolina State College.

The new officers elected for the coming year include: R. W. Neilson, director of public works, Winston-Salem, president; Robert Coleman, director of public works, Wilmington, vice president; and S. Leigh Wilson, North Carolina League of Municipalities, secretary-treasurer. Newly elected to the Board of Directors for two-year terms are: C. K. Beatty, director of public works, Greenville; and W. E. Edens, director of public works, Kinston.

The keynote speaker for the conference was Robert D. Bugher, Executive Director of the American Public Works Association. Featured topics of the conference included cooperative highway and street planning, public works requirements under North Carolina's new annexation law and a session devoted to methods and equipment required for making a city attractive.

In his keynote address Bugher called attention to the many public facilities in an urban community

Button, button—push the button—and up goes the new Holan 2600-A Ladder.

The same fingertip control that made the Holan 2600—which the 2600-A replaces in the Holan line of fine aerial ladders—is present in this new model. The pushbutton control station is on the mast—and a station can be installed on the upper side rail for remote control by the man on the platform.

But a host of important design changes have been made in the 2600-A. A plate metal support frame replaces one of tubular construction; the crank for 360° rotation has been located on the left side, out of the way of the pierced metal, non-skid pedestal steps; and both the dual-level platform and 12,000-volt woodstrain insulators have been made standard equipment on the 2600-A.

The 2600-A is available in heights to 32 feet. Fiberglass covering of side rails and remote pushbutton controls optional.

Holan Corporation, 4100 W. 150th St., Cleveland 35, Ohio
Plants in: Cleveland, Ohio; Griffin, Georgia; Phoenix, Ariz.

Holan

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HOLAN

that are usually taken for granted by the average citizen and yet which are indispensable to urban living.

Commenting on the important role of the public works official, Bugher stated, "He continually helps to translate the abstract ideal of promoting the general well-being of the public into facilities and services of real value. But he receives little praise and gets little recognition in return for his diligence in safeguarding the public health, providing better streets and highways, making the city a cleaner and more enjoyable place to live, and at the same time, operating within a very limited budget and trying to save the tax payer money."

The importance of the public works program, he added is shown in the fact that cities with populations of 25,000 or more are spending, by themselves, in excess of five billion dollars each year, more than 40 percent of their total budgets, on public works.

Concluding, Bugher said that a new burden is being placed on the public works official in terms of expanded public facilities as a result of a rapid urban growth. To meet these challenges he said we must think more about professionalizing our staffs, utilizing the findings of research and improving communications and intergovernmental relations.

Others taking part in the program were Hugh L. Medford, director of public works for the city of Greensboro and president of the N. C. Chapter of the American Public Works Association; John Slayton, field consultant for the American Municipal Association, Washington, D.C.; Cameron Lee, chief engineer for the N. C. Highway Commission; J. D. Mackintosh, city manager of Burlington; John T. Morrisey, general counsel for the N. C. League of Municipalities; A. C. Hall, director of planning, Raleigh; R. W. Neilson, director of public works, Winston-Salem; and William Boothe, Boothe Aerial Survey Company, Greensboro.

S. Leigh Wilson, assistant executive director of the N. C. League of Municipalities, presided over the opening session, and Prof. Charles Smallwood of the college's Department of Civil Engineering served as chairman of the afternoon meeting. Clifton Beckwith, executive secretary of the N. C. State Employees Association, was guest speaker and T. B. Morris, Jr., city engineer of Hickory, presided at an evening banquet.

The Thursday program was entitled "Keeping Your City Attractive." Prof. J. W. Horn of the college's Civil Engineering Department presided.

Speakers included Theodore H. Noe, sanitation superintendent, Winston-Salem; Tom S. Osborne, assistant director of public works, Greensboro; Dr. R. P. Upchurch, professor of field crops, North Carolina State College; and R. J. Pearce, landscape architect, Raleigh.

1960 Western Public Works Conference Scheduled for May 16, 17 and 18

Fresno, California, gateway to the Sierra Wonderland, is the setting for the 1960 Western Public Works Conference to be held May 16, 17 and 18. The Western Conference, to include technical sessions and a working equipment show, is being sponsored by the Central California Chapter of the American Public Works Association. The Conference covers 13 Western States including Alaska and Hawaii.

Among the highlights of the meeting will be a trip to the Haas Powerhouse, the largest and the deepest underground hydro plant in the United States, located in the heart

NEW... M&M BEAVER
BRUSH CHIPPER
M&M
BEAVER
the only brush chipper that produces large or small chips
MITTS & MERRILL, SAGINAW, MICHIGAN
BUILDERS OF SPECIAL MACHINERY SINCE 1854

Write today for closest dealer and catalog No. 657 which gives the facts and exclusive features on all six new models of M&M Brush Chippers. See . . . Compare . . . Buy an M&M Beaver, America's No. 1 Brush Chipper. *Dealer inquiries invited.*

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BUILDERS OF WORK-SAVING, MONEY-SAVING AND MATERIAL RECLAIMING MACHINERY SINCE 1854

The new incinerator at Whitemarsh. Note the neat compact lines of the building and the low stacks of the wet scrubbers which emit only a plume of steam. Glace & Glace Inc. were consulting engineers for the project.

Only these four men are needed to operate the plant: One man to weigh incoming trucks and supervise unloading, a second to operate the conveyor, a third to load and drive the truck carrying away the non-combustible residue, and a supervisor.

Storage conveyor consists of two, 50-ton capacity oscillating hoppers placed side by side but independently controlled. Material is moved to feeders in a series of short reciprocating arcs. This action is self-scouring and keeps the storage trough completely clean.

NOW SERVING 50,000 RESIDENTS . . .

NEW PRINCIPLE INCINERATOR

eliminates mess and fumes—is economical to operate

Designed to burn 12½ tons of refuse *per hour* without odor or dirt, this new incinerator is in operation at Whitemarsh, Pa. In addition to garbage, tin cans, lawn trimmings and wastepaper, the incinerator handles undigested sludge from an adjacent sewage plant. Located in a residential section, plant exterior and landscaping are designed to harmonize with their surroundings.

The Dravo Incinerator has a number of unique features. Of primary significance are: the continuous flow design, which permits rapid and easy handling of the refuse; the water wall furnace, which permits the use of sufficiently high temperatures to provide thorough combustion and the elimination of noxious odors; and the wet scrubber and residue disposal system, which together promote the maintenance of healthful cleanliness.

Automatic operation has been stressed, only four men are required to run the entire plant. Present needs demand operation of the plant for only one 8-hour shift, but since it can be run on a 24-hour basis, there is adequate capacity for future needs.

The Dravo Incinerator is the economical solution to the problem of sanitary, convenient refuse disposal. For full information, write or call DRAVO CORPORATION, PITTSBURGH 22, PENNSYLVANIA.

DRAVO
CORPORATION

SPECIFY A *Proven* SUBMERSIBLE PUMP

SPECIFY "weil"

weil Submersible Sewage and Sump Pumps have been in use since 1951. There is no substitute for experience.

NOW AVAILABLE in a choice of two motors

1750 R.P.M. and Low Speed 1140 R.P.M. for longer life, less wear and improved non-clog characteristics.

NOW AVAILABLE with a choice of two controls

Conventional float switch

MICRO Pressure switch (as illustrated)

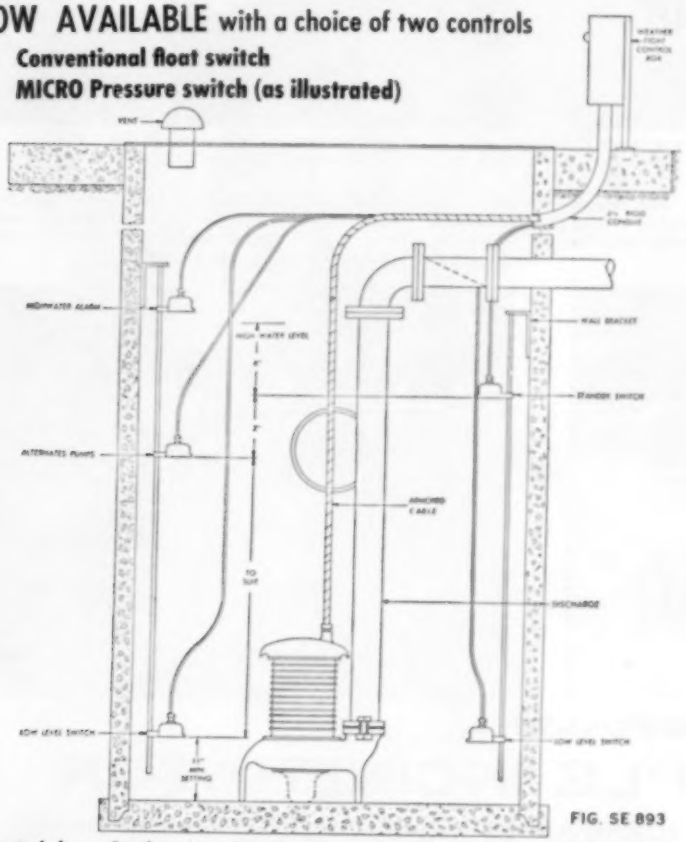

FIG. SE 893

Illustrated is a Duplex Installation of two **weil** Submersible Sewage Pumps employing MICRO Switch controls to start and stop pumps; to alternate pumps; and to provide for high water alarm. Note the ease with which switches are positioned (or changed) to control water levels. The Submersible MICRO Switch has no exposed moving parts, needs no servicing and coupled with the **weil** Submersible Pump provides an extremely efficient non-clog trouble-free pumping system.

weil Submersible Pumps are manufactured in discharge sizes of 3" to 6" and capacities to 2000 G.P.M. There is a **weil** Submersible Pump to meet all requirements. **Now approved by the CANADIAN STANDARD ASSOCIATION Testing Laboratories.**

Send for Bulletin SE-860 for complete engineering information.

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of the Sierra Nevadas. On the agenda for the ladies will be a trip to beautiful Yosemite Valley.

Among the technical sessions being planned is a panel on "Mechanics of Soil Control." Participants on the panel will discuss Soils, Materials, Laboratory and Field Experience; Maintenance of Streets; Stabilization of Excavations and Fills, and End Result vs. Methods Specifications.

A panel concurrent to the one mentioned above will concern itself with "Coordination of Public Improvements." The major topics to be discussed will include: Street Planning by Metropolitan Areas; Planning, Notice and Scheduling of Public Improvements, and Public Works and Redevelopment Planning.

Other featured subjects during the three-day meeting in Fresno will include papers or talks on public works topics such as: "The Freeway Program," "Engineering Procedure Improvement," and "Standards, Uniformity and Construction Costs."

Outstanding men in the public works field will be participating in the Conference. Mark the date May 16-18 on your calendar now so you don't forget—it's a meeting you'll want to attend. The Headquarters will be at the Hacienda Motel in Fresno. For further information contact: J. E. Fitzgerald, 1455 Van Ness Ave., Fresno, California.

Planning and Administrative Procedures Discussed at Indiana Conference

Indianapolis, Ind. — The Indiana Chapter of APWA braved wintry elements to sponsor an "Orientation Conference for Newly Elected Public Works Officials" in Indianapolis, February 24 and 25.

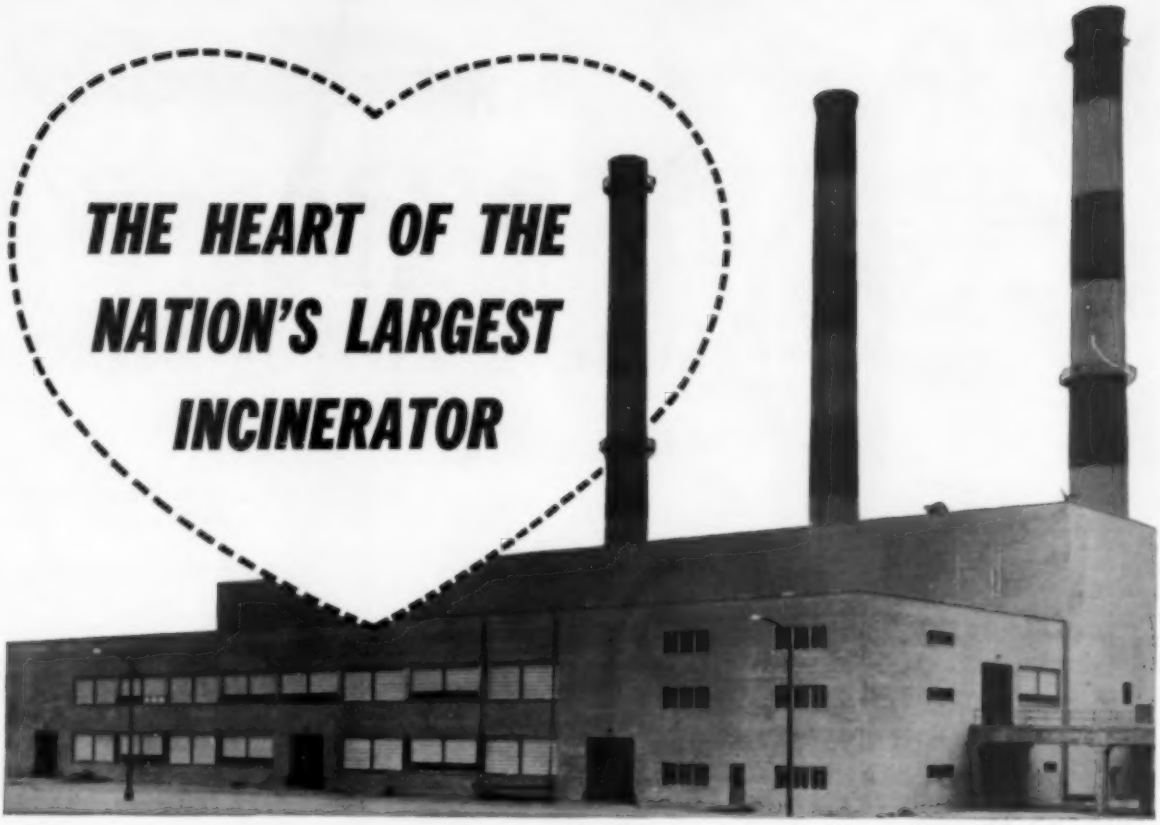
An excellent array of speakers discussed some of the latest thinking in public works planning and administrative procedures with a view of Indianapolis in the background providing a fine example of the results of such work.

Ellsworth Maxwell, executive secretary of the Indianapolis Board of Public Works, welcomed the delegates and served as moderator of the panel on "Public Works Planning." Mr. Maxwell proudly commented on the selection of Indianapolis as the cleanest city in the United States.

All speakers urged the new officials to consider the benefits of long range planning. It was pointed

(*Continued on page* 189)

THE HEART OF THE NATION'S LARGEST INCINERATOR



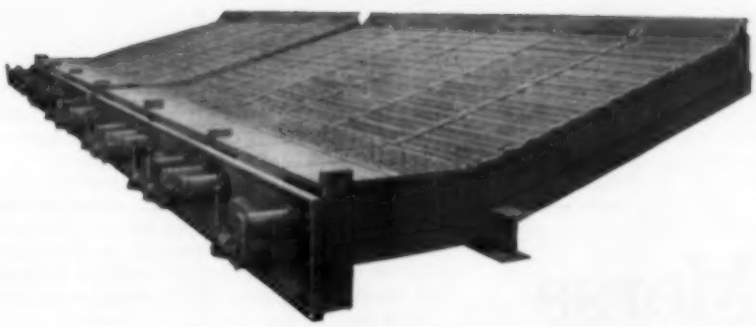
Chicago's 1200 Ton Calumet Incinerator Plant

Richard J. Daley, *Mayor*
George L. DeMent, *Comm. Public Works*
Lloyd M. Johnson, *Comm. Streets & Sanitation*
Paul Gerhardt, Jr., *City Architect*
Robert Stellwagen, *Consulting Engineer*

the F&E Multi-Cell Incinerator Stokers

Furnaces equipped with "F&E" Multi-Cell Incinerator Stokers are assured of complete flexibility of operation—the utmost in economy—lifetime dependability.

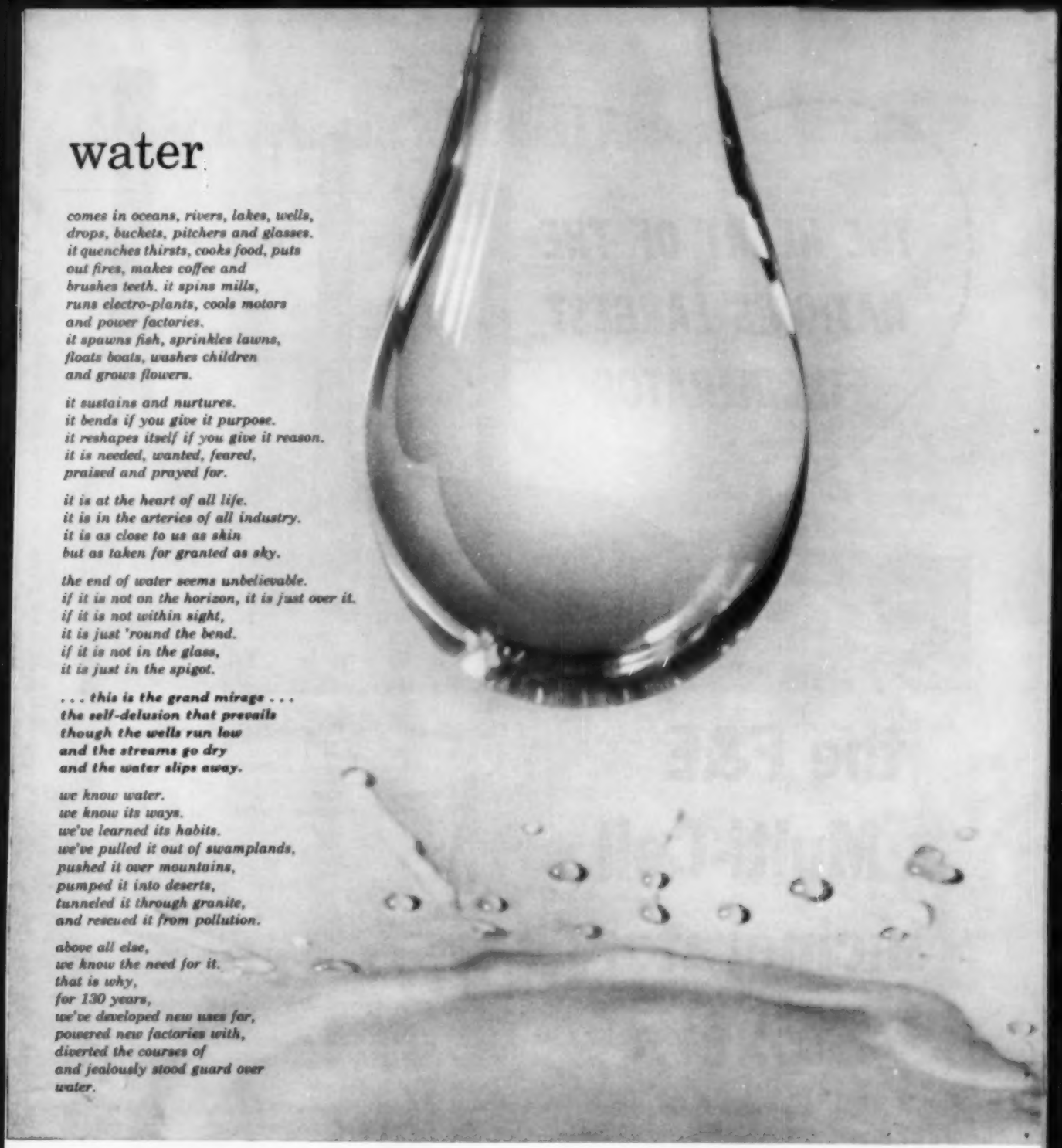
Contact F&E today for engineering details and data.



F&E

FLYNN & EMRICH CO.

Baltimore 2, Maryland



water

comes in oceans, rivers, lakes, wells,
drops, buckets, pitchers and glasses.
it quenches thirsts, cooks food, puts
out fires, makes coffee and
brushes teeth. it spins mills,
runs electro-plants, cools motors
and power factories.
it spawns fish, sprinkles lawns,
floats boats, washes children
and grows flowers.

it sustains and nurtures.
it bends if you give it purpose.
it reshapes itself if you give it reason.
it is needed, wanted, feared,
praised and prayed for.

it is at the heart of all life.
it is in the arteries of all industry.
it is as close to us as skin
but as taken for granted as sky.

the end of water seems unbelievable.
if it is not on the horizon, it is just over it.
if it is not within sight,
it is just 'round the bend.
if it is not in the glass,
it is just in the spigot.

. . . this is the grand mirage . . .
the self-delusion that prevails
though the wells run low
and the streams go dry
and the water slips away.

we know water.
we know its ways.
we've learned its habits.
we've pulled it out of swamplands,
pushed it over mountains,
pumped it into deserts,
tunneled it through granite,
and rescued it from pollution.

above all else,
we know the need for it.
that is why,
for 130 years,
we've developed new uses for,
powered new factories with,
diverted the courses of
and jealously stood guard over
water.

Fairbanks, Morse

A MAJOR INDUSTRIAL COMPONENT OF FAIRBANKS WHITNEY CORPORATION, NEW YORK

Whatever your pumping needs . . . whether your problem is flood control, irrigation, water systems, dams or reservoirs . . . whatever your concern with water may be . . . we can help you.

Our pumps . . . our generators and controls . . . our new rotary compressors . . . our drive toward better ways to de-salt ocean water . . . the potential of our advance Research & Development Center in Beloit . . . our lead position in the field of Hydrodynamics . . . all of these equip us to serve you.

Send for our brochure—"Hydrodynamics." Please write to Mr. Robert W. Kerr, President, Fairbanks, Morse & Company, 600 South Michigan Ave., Chicago 5, Illinois.

Municipal Power

CAPACITORS FOR ELECTRIC DISTRIBUTION SYSTEMS

BRUCE J. ENNIS

Principal Engineer,
Burns & McDonnell Engineering Co.,
Kansas City, Missouri

ALTERNATING CURRENT generators in power plants have a dual purpose. In addition to providing the distribution system with the required amount of kilowatts demanded by the power, lighting, and heating loads of consumers, they must supply the reactive kilovolt-amperes, or kvars, required to magnitize substation transformers, distribution transformers, induction motors, and other consumer equipment connected in the system; and to supply the reactive power required by the magnetic fields surrounding pole line wires and other distribution circuit conductors.

In effect, an alternator might be considered as a kw generator and a kvar generator mechanically connected on a common shaft with the diesel engine, water wheel, or steam turbine which provides the propulsion of the unit. Increasing the flow of oil, water, or steam, respectively, to the prime mover increases the torque imparted to the kw generator and supplies additional real power or kw to the system. Increasing the excitation on the generator field produces additional reactive power or kvar for the system. The kilovolt-amperes or kva, which is the vector sum of the two components of real and reactive power, represents the actual total current which must flow through the distribution system to supply the loads of the consumers and system losses.

This total current flowing through the generator windings, transformer coils, and distribution circuits causes resistance heating losses which impose thermal limitation on the capacity of these system components to serve consumer loads. In addition, this current creates a voltage drop from source to consumer, which sets a limit on the utilization of the load current at the receiver end. Obviously, the lower the magnitude of the current required to serve system loads, the greater would be the released capacity in plant and substation equipment and the lower would be the voltage regulation on distribution circuits.

In the optimum distribution system, maximum kw load requirements could be served if there were no kvar demands whatever. In this case, the kva and kw currents would be equal and the load power factor would be unity, as in a direct current system. Actually, in alternating current distribution systems, reactive power demands are inherent, and must be served in like manner as the real power loads.

In normal distribution practice, there are two ways in which the kvar requirements may be served. As described above, one method lies in the production of reactive power in the power plant generating equipment, from which it must flow all the way through the distribution system to ultimate consumer loads (creating losses, voltage drop, and absorbing surplus capacity en route). The second method is to supply the kvar requirements directly at the load points out on the distribution feeders by installing shunt capacitors at such points to produce locally the necessary reactive power, and thus reduce the kvar flow through system generators, substation transformers, and lines.

By installing capacitors close to load points, additional capacity is released in system equipment to serve real power loads, voltage levels are improved, and system losses are reduced. Assuming an initial system load power factor of 70 percent, for example, then supplying of all the reactive power requirements from capacitors located at load points, instead of from the power plant generators, would release over 35 percent of generating and sub-

John W. Wakefield (left), Director, Florida Department of Water Resources, and Sam A. Thompson, Chairman, Mississippi Board of Water Commissioners, view a huge enlargement of a Fairbanks, Morse water ad displayed at recent Interstate Conference in Chicago.

Wherever water experts meet Fairbanks, Morse is there

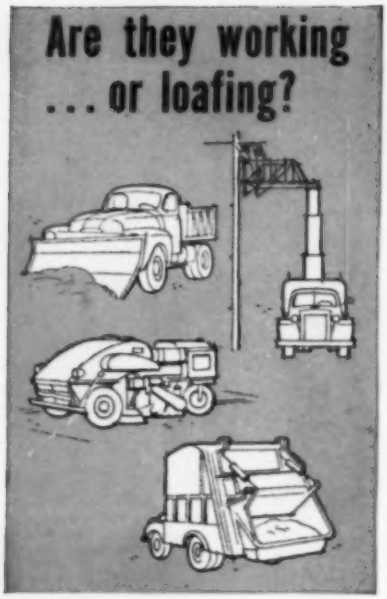
JUST as at the recent Interstate Conference on Water Problems... when water authorities get together, Fairbanks, Morse is a name known to all.

This is only natural, since no other manufacturer builds pumps for so great a variety of municipal hydraulic applications—from 200 gph to 800,000 gpm, and to 3000 psi. *Matched* F-M power units help assure lowest-per-gallon costs.

Confidence based on long buying experience explains why more local governments call for Fairbanks, Morse pumps than any other kind ... why F-M pumps are still, today, the "standard for comparison" wherever water experts meet!

Fairbanks, Morse
Pump and Hydraulic Division
Kansas City, Kansas

A MAJOR INDUSTRIAL COMPONENT OF FAIRBANKS WHITNEY CORPORATION, NEW YORK



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If your equipment is working a full day!

SERVIS RECORDERS show "idle time" and "busy time"

Exactly!

Guard against costly inactivity! Install tamperproof Servis Recorders on street cleaners, dump trucks, front-end loaders and municipal and county fleets.

A clock mechanism turns a chart on which is accurately recorded the length of all stops and delays as well as the working time of all equipment. Engine idling time, too, can be recorded distinctly so that fuel economies can be effected.

Permanent records made for one day, three day, or weekly periods.

Used by progressive commercial truckers for 46 years... *The low cost will surprise you!*

Ask for the name and address of Mr. S-R, our nearest qualified representative, for help on your problems or write for our new "Off-the-Highway Bulletin"

THE SERVICE RECORDER COMPANY

10150 Rockwell Ave. • Cleveland 14, Ohio

station capacity for use by additional real power loads, and peak hour system losses would be reduced nearly 50 percent.

On a typical 4/0 copper conductor distribution feeder, the voltage drop caused by the kvar reactive power current at 90 percent power factor is greater than the voltage drop created by the kw real power load current, thus contributing the major portion of the voltage limitation on such a feeder and taxing the ability of feeder voltage regulators to maintain proper voltage levels. If shunt capacitors were installed at load points near the end of the feeder, to raise the power factor to unity, the kilowatt load in the feeder could be nearly doubled, without exceeding the original voltage drop limitations, and additional regulation range would be released in voltage regulating equipment within the thermal capabilities of the feeder circuit.

In general, the proper use of shunt capacitors on distribution systems will raise thermal and voltage limitations on existing generation and distribution equipment and circuits, and will reduce the cost of system losses. In certain cases, their use may defer the need for the heavy investment required for additional generating equipment, substation transformers, feeder voltage regulators, new feeder circuits, and the like, at considerably less cost.

Capacitors may be installed in large banks on distribution substation busses, in pole mounted groups on primary feeder lines, or as secondary capacitors on the load side of distribution transformers. The specific needs, the technical requirements for the amount, type, and location of the capacitors, and the economic factors affecting the application of capacitors for the individual system are best determined from engineering studies and by reference to catalog data, and descriptive and application bulletins and charts published by manufacturers of capacitor equipment. All studies concerning the use of capacitors should consider their effect on voltage rise on the system during light load periods (which might require the use of automatically switched capacitor banks rather than continuously energized banks), and their possible effect, in certain instances, on noise frequency induction in communication circuits.

Normal generation and distribution systems require an investment in excess of $200 per kw. Shunt capacitor banks vary in price from two and one-half to five dollars per kvar approximately, in the usual range of voltages and capacities for fixed and switched capacitors. Considering the potential release of real power capacity which might be obtained for the individual system by the use of reactive power correction capacitors, it is apparent that the possibility exists for the economical application of capacitors for most systems.

• • •

Private and Backyard Swimming Pools and Water Use

The fantastic increase in the number of private or yard swimming pools over the past few years poses a problem for many water departments. As of now, it appears that nearly all water departments supply such pools with needed water. What the policy will be if and when another dry year occurs and water use becomes critical is something else.

In a questionnaire to engineers and superintendents of Water Works, sent out by the Editors of PUBLIC WORKS in the summer of 1959, the following questions were asked:

About how many backyard (private) swimming pools are there in the area your department serves?

Do you permit unrestricted use of city water by such pools?

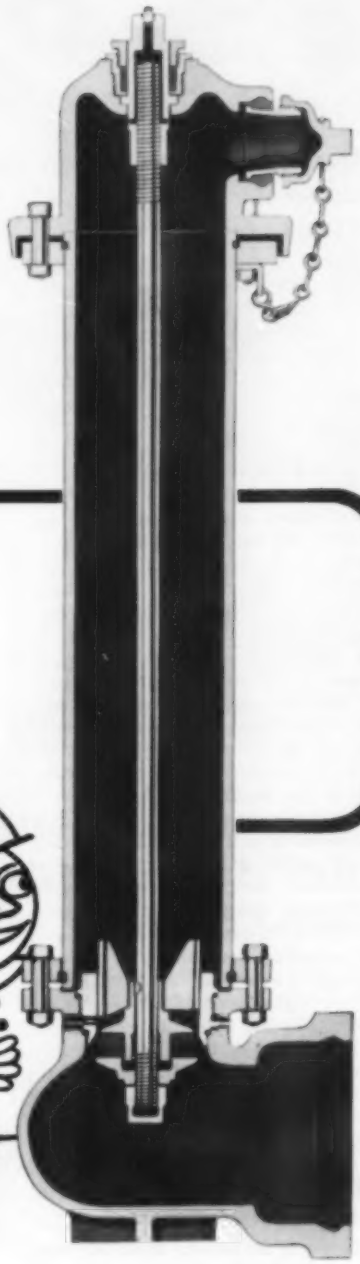
About 4600 questionnaires were mailed and approximately 1200 were returned. The first 598 returns were tabulated for replies to the above questions. These returns covered all states and were deemed representative.

There were reported definitely 29,935 private pools, but many departments made general statements that could not be included in the total. One large southern city, for instance, reported "thousands of them." While 20,428 of the 29,935 pools definitely reported were in California, nearly all states are included; 3 cities from Connecticut report 111 pools; 23 Illinois cities have 809 pools; etc.

Most cities do not restrict the use of water for such pools, but some require filters on all pools. This may be for the purpose of water conservation or for health protection, or both. A partial tabulation covering mainly California and some southern states indicated that about one-sixth of the cities enforce more or less severe restrictions on water use for pools. Another partial tabulation covering mainly northern states showed that only one in 12 cities restricted water use. However, some others did restrict the momentary rate of use.

THE R. D. WOOD HYDRANT

The R. D. Wood Hydrant is simple in design, yet offers all the features needed for the utmost reliability. Your community would have to look a long time before it would find another hydrant so serviceable and rugged. For full neighborhood protection at minimum outlay, look first at R. D. Wood Hydrants.



BRONZE PARTS

Every point of friction is protected by at least one bronze surface. This assures against rust and interference with operation. The stuffing box, gland and operating nut are *all bronze*—corrosion-proof!

AND THESE FEATURES, TOO:

Valve opens against water pressure, remains closed in case of accident. Head revolves 360°. Optional break-point flange and breakable stem coupling permit quick repair without excavating. Optional extension piece can be inserted without shutting off water. Available with bell, mechanical joint or flange pipe connections; conventional or "O" ring packings.

Conform to latest AWWA specifications

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Manufacturers also of Mathews Modernized Hydrants, Mathews Flange Barrel Hydrants, R. D. Wood Gate Valves, and "Sand-Spun" Pipe (centrifugally cast in sand molds)

THE HIGHWAY AND AIRPORT DIGEST

Prepared by **FRANK FORCE,** *Digest Editor*

Principles of Soil Engineering

This is Part II of the Principles of Soil Engineering and covers investigation, analyses and special problems in design. The collection of data that is pertinent to the problem includes both field and laboratory investigations. These studies answer the questions: 1) What material is present?; 2) How much of it is there?; 3) In what condition is it?; 4) How will it react to stress? Field investigation is discussed under the headings of equipment, field identification and field testing. For foundations, whether for a bridge, a building, a highway embankment, a dam, or a pavement, the most serious problem is generally one of settlement. Also, for slopes, including cuts, fills and trenches, the problem of stability (shear) is normally paramount. Permeability, while affecting strength insofar as the location of the water table is concerned, is most frequently associated with problems of losing or gaining water, as exemplified by the question of water losses through or under an earth dam. Under special problems, the following problems and the basic soil considerations involved are discussed: 1) Pavement design; 2) frost action; 3) pumping; 4) shrinkage and swell; and 5) sand drains.

"Principles of Soil Engineering—Part II." By Robert F. Baker, Professor of Civil Engineering. The Ohio State University. PUBLIC WORKS, March, 1960.

Pretension Prestressed Pavement

There is an urgent need for prestressed pavement for runways to meet the demands of more traffic and heavier aircraft. The principal advantage of prestressed runways is in their low maintenance cost resulting from an elimination of cracks during the service life of the pavements. Other benefits of prestressing include, in effect, an increase in the tensile strength of concrete with simultaneous homogeneity and continuity imparted to the pavement. Elimination of contraction joints and wider spacing of expansion joints, coupled with a high increase in load carrying capacity, are further benefits. For example, a 6-in. concrete slab, initially prestressed in two directions with as little as 200 psi, can carry planes with wheel loads of 100,000 lbs. and still have a large reserve capacity. Theoretically, prestressing can be achieved by either post-tensioning or pretensioning. Post-tensioning is commonly achieved by inserting conduits with cables in the forms before placing concrete. After the concrete has hardened, the cables are tensioned by jacks or take-up nuts. In pretensioning the strands are tensioned to the desired intensity first. Concrete for the pavement is then placed. After the concrete has hardened, the strands are released from their abutment, and their pull is transferred as compressive stress to the hardened concrete. In the theoretical principle of portable abutments, pavement can be constructed in sections, with necessary gaps between sections filled in later. With a method for imparting continuity between the main sections through the gaps, the portable abutment could be used to construct pavements of any desired length without joints.

"A New Way to Pretension Prestressed Pavement." By Dr. Lev Zetlin, Consulting Engineer. *Consulting Engineer*, February, 1960.

Curb Heights and Car Doors

The following factors influence the relationship between the curb and the door: Height of door; length of door; angle at which it rotates; weight of persons and position within vehicle; springing of vehicle; height of curb; slope of sidewalk;

● **MOWING along Illinois Tollway. An International tractor equipped with a 6-foot Mott hammer knife mower and two 4-ft. trailing units covers 10 to 12 acres in a day.**

Supts. tell why City of Jacksonville owns 7 Michigans *(5 Tractor Shovels, 1 Crane, 1 Dozer)*

"Versatile, dependable"

"We use this 2-yd Michigan Tractor Shovel for digging ditches, laying pipe, *and* backfilling. In the four years we've had Michigans, we haven't lost more than a few days work per machine due to mechanical troubles."

—Supt, Sewer Dept

"Half-day, 6-man job cut to ½ hour, 1 man"

"To move and set our old crawler-crane in position for loading at our sand pit formerly took six men half a day. Our 1¼ yd 26 mph Michigan Tractor Shovel has reduced travel to ½ hour, set-up time to nothing. In fact, Michigans are so fast and mobile our *one unit alone* handles grading, cold patching and other repairs at *all three of our airports.*"

—Supt of Maintenance, Airport Dept

"Mobile, well-built"

"Like our Michigan Tractor Shovels and Dozer, our Michigan Crane drives everywhere under its own power. We like its capacity (25 tons, ¾ yds) . . . its rugged carrier (with planetary wheel axles) . . . its good maneuverability."

—Supt, Highway Dept

"Handles landfill at 5 dumps"

"We've had our 162 hp Michigan Tractor Dozer on landfill garbage work for two years now and haven't had a bit of tire trouble. Dozer covers from three to five dumps a day, traveling under its own power from job to job."

—Supt, Street Dept

For the proof of demonstration, see your local Michigan Distributor. Or write:

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and crown of road. A detailed survey of typical car-door conditions and trends brings out the following points: 1) Generally speaking, clearance from ground at door post has remained fairly constant in the 10 to 13-in. range; 2) with few exceptions, clearance from the ground at the end of the door is greater than the door clearance at the door post; 3) the cant of the car with a 180-lb. load on the curb side is ½-in. to 1-in. measured at the end of the door; 4) car door length measured perpendicular to a plane through the outside of the wheel varies with the model; and 5) although some cars have maintained or increased their ground-to-opened-door clearance, most cars have decreased theirs. Generally curbs are built about 6 in. high measured at the gutter line. However, with the changes in vehicle design a 4-in. curb would sacrifice little safety and would increase the ease with which cars can be entered or left. Vertical and rolled curbs are about the same as they affect the problem under consideration. However, drivers by partially mounting the rolled curb can make it considerably easier to enter or leave the car on the curb side than if the curb is vertical.

"Curb Heights and Car Doors." By Douglas J. Carmody, Director, Parking and Traffic and George Earl, Engineering Aide, City of Modesto, Calif. *Street Engineering*, February, 1960.

Forecasts of Population and Car Registrations

According to forecasts made by the several State highway departments (excluding Alaska and Hawaii), there will be 230 million people living in the U. S. in 1976. During that year, these people are expected to register 114 million motor vehicles, which will travel 1.2 billion vehicle-miles. The estimate thus predicts a 37 percent increase in population over 1956, the base year of the forecasts; increases of 75 percent in motor-vehicle registrations and 93 percent in travel are expected. The forecasts, prepared by the States for the Bureau of Public Roads Highway Cost Allocation study, are based, in general, upon the continuation of recent trends in population, living standards, density of motor-vehicle ownership, and characteristics of motor-vehicle use. Significant changes in any of these basic trends during the period involved could be expected to have marked effects upon the accuracy of these forecasts.

"Forecasts of Population, Motor-Vehicle Registrations, Travel and Fuel Consumption." By Thomas R. Todd, Head, Revenue Planning Section, Highway Needs and Economy Div., Bureau of Public Roads. *Public Roads*, February, 1960.

Reduce and Conquer Paper

Paper work and red tape can be cut and volume of files can be reduced in government offices. The flow of paper work in and out of the construction department of the California Division of Highways has reached staggering proportions. Because of duplication and excessive work, a contract was awarded to a management-consulting firm to conduct a survey of the record-keeping systems and make recommendations for improving the operation of handling paper work. One of the most important steps taken was the establishment of a records center, a low-cost depository for records that can no longer be termed active or current, but to which infrequent reference can be made until their retention period has been terminated. Using the file-retention schedule about ¼ the original space was required. A major part of the physi-

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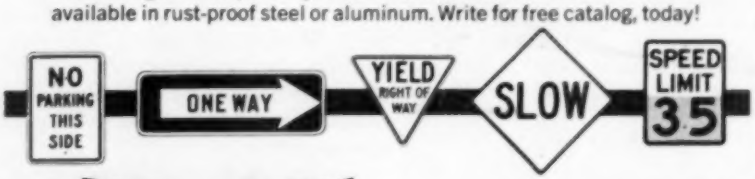
TRAFFIC CONTROL SIGNS BECAUSE THEY LAST SO LONG!

More cost-conscious communities choose **Miro-Flex** — because **Miro-Flex** signs are embossed and quality-finished, to last years longer than ordinary flat-surfaced signs! Embossed design gives extra strength and rigidity — raised letters are easier to read. **Miro-Flex** offers a complete line of street name assemblies and traffic control signs — at prices you can afford. Street name assemblies available in rust-proof steel or aluminum. Write for free catalog, today!



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Top Performance . . .

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TRACTOR SHOVELS
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TROJAN TRACTOR SHOVELS ARE AVAILABLE IN 8 MODELS, LIFTING CAPACITIES FROM 6,000 TO 24,000 LBS.

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"No corrosion, negligible maintenance and continued high carrying capacity with Transite Pipe."

JOHNSON & ANDERSON, INC., CONSULTING ENGINEERS, PONTIAC, MICH.

"First cost and economical operation make Johns-Manville's Transite Pipe a practical long-term investment," say Messrs. Johnson and Anderson, consulting engineers, pictured at right. "Despite this economy its performance is superior in many ways. There's no corrosion, negligible maintenance and continued high carrying capacity . . . helping through the years to save in the operation of the system. These many economies make it easier for communities to build and expand their water systems."

Transite's maintained carrying capacity keeps pumping costs low. Its strength, durability and corrosion-resistance cut maintenance—provide years of trouble-free service. Further savings are effected by the sure coupling method that assures a tight seal at every joint. Add to this Transite's natural interior smoothness and you see why it helps reduce community water system costs. Let us send you "Facts and Data for Engineers" book. Write Johns-Manville, Box 14 (PW-4), New York 16, N. Y.

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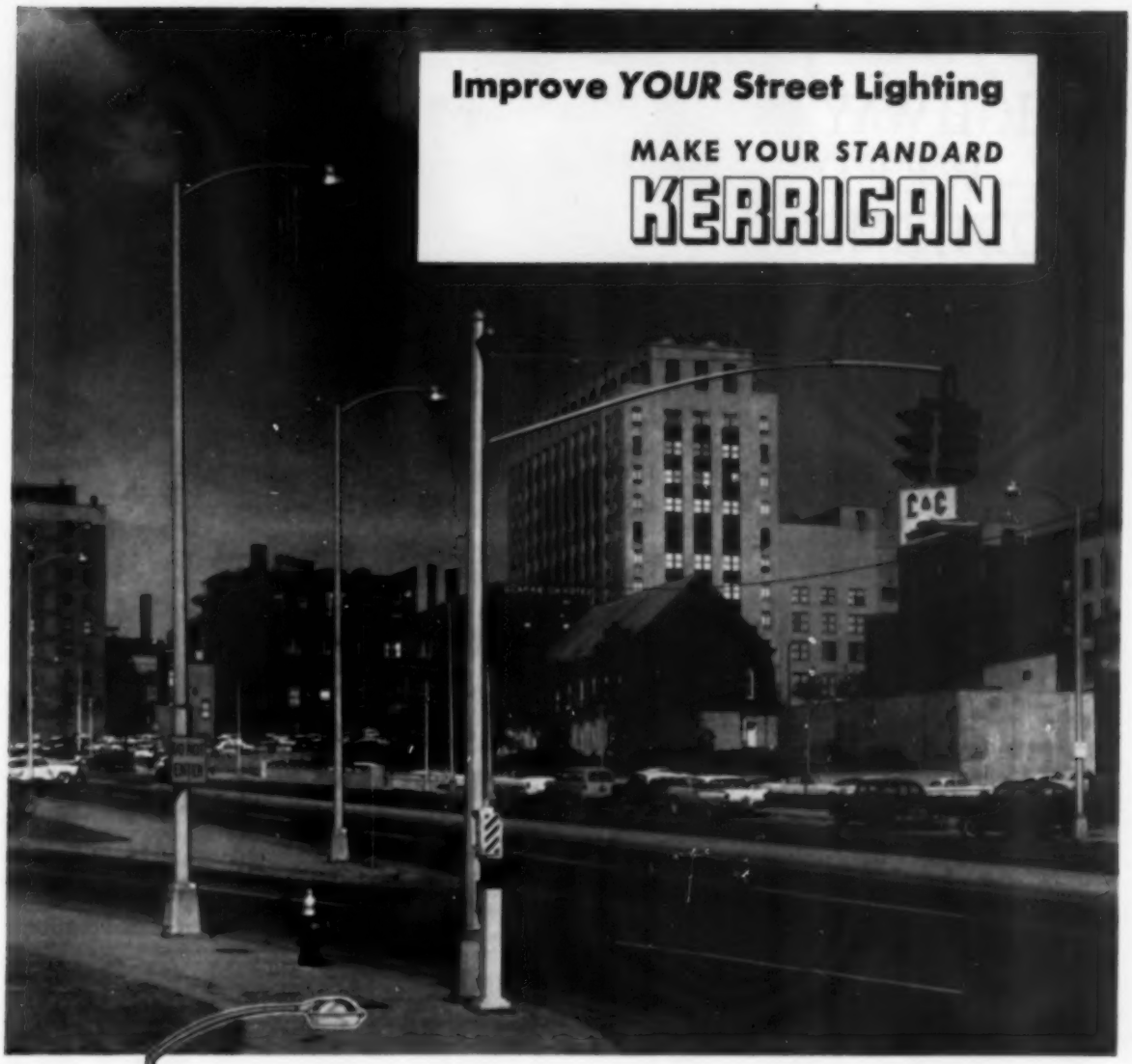

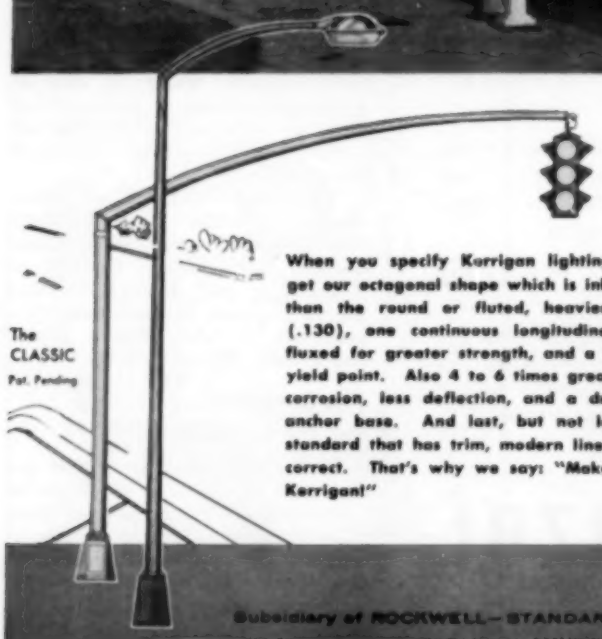

When you specify Kerrigan lighting standards you get our octagonal shape which is inherently stronger than the round or fluted, heavier wall thickness (.130), one continuous longitudinal weld magnafluxed for greater strength, and a guaranteed high yield point. Also 4 to 6 times greater resistance to corrosion, less deflection, and a drop forged steel anchor base. And last, but not least, you get a standard that has trim, modern lines, architecturally correct. That's why we say: "Make Your Standard Kerrigan!"

Our new 70-page catalog has the engineering facts on both steel and aluminum standards! Won't you write for your FREE copy now? Address: Dep't. P-4.

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Subsidiary of ROCKWELL—STANDARD Corporation

HIGHWAY WEED PROBLEMS LIKE THESE CAN BE ELIMINATED LIKE THIS WITH AMIZOL WEED KILLER

and Amizol combinations

Using Amizol alone, or in combination with other weed killers, state and local highway departments are instituting successful and complete vegetation control programs along thousands of miles of roadsides, guard rails, gravel shoulders, bridge abutments, center strips and embankments.

Amizol combinations provide longer control of more broadleaf weeds and grasses than any product used alone. They produce rapid knockdown of existing vegetation, better kill of deep rooted perennials and keep the treated area free of weeds all season long.

Costs for total vegetation control are considerably less with Amizol combinations . . . by 30 percent or more. You use less chemical to kill more weeds. Your "spraying season" is longer, just as long as weeds are green and actively growing.

For information on how to begin a practical highway weed control program, write for free booklet describing uses, application data and chemical formulations of Amizol—produced by Amchem Products, Inc., originators of 2,4-D and other basic weed killers.

AMCHEM AMIZOL

Amchem and Amizol are registered trademarks of
AMCHEM PRODUCTS, INC. (Formerly American Chemical Paint Co.)
AMBLER, PA. • St. Joseph, Mo. • Niles, Calif.

cal reorganization was the shift of most of the records from drawer-type filing cabinets to vertical file units. These eight 6-shelf units were installed in a centrally located file room. In addition to the vertical file units, there are three 4-drawer and five 5-drawer file cabinets, three bookcases and two desks, all in a room approximately 16 ft. square. The drawer-type files were retained for material to which less frequent reference is made, but which cannot be sent to the records center. Two file clerks were assigned the full responsibility for the distribution and retention of the paper work.

"Reduce and Conquer Paper!" By E. L. Tiedemann, Administrative Assistant, Construction Department, California Division of Highways. *Better Roads*, January, 1960.

Hot Mix for Thin Surface Treatments

Experience in Massachusetts has indicated that thin (½-in. or less) surface treatments using a dense hot bituminous plant mix can be laid successfully by regular bituminous concrete finishing machines. Material specifications have been modified by reducing the top size aggregate to all passing the 3/8-in. sieve and increasing slightly the amount passing the No. 10 sieve. The binder used is 85-100 or 100-120 penetration grade asphalt. This type of surface treatment offers: 1) Economical construction costs (in one case as low as 23¢ per sq. yd.) and low maintenance costs; 2) safety for the user; 3) smoothness and quietness; 4) pleasing and uniform appearance; 5) increased structural strength; 6) tight surface against water; 7) ease of construction (with a minimum of delay to traffic after placement and a high degree of quality control at the plant).

"Hot Mix for Thin Surface Treatments." By Egon Tons, Assistant Professor of Transportation Engineering, Massachusetts Institute of Technology and John Chin, Research Engineer, Massachusetts Department of Public Works. *Roads and Streets*, February, 1960.

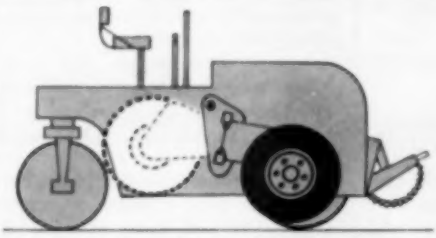
The Consultant and the Computer

Civil engineering firms that investigate the merits of electronic computers for their own use soon find that the anticipated aura of mystery fails to materialize. Instead, the process closely resembles a typical engineering study. The mechanics of a study on the feasibility of a computer are not complicated.

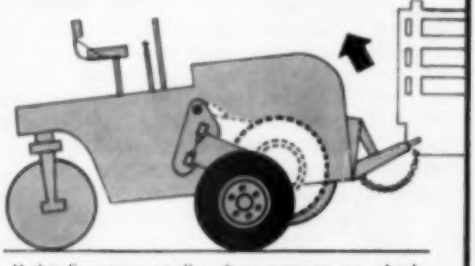
In Galt, Ontario, busy Buffalo-Springfield KT-8 works and runs on fast schedule. Towing wheels, hitch, remain intact — an important time-saver on scattered job assignments around town.

Head-on view shows how fold-away wheels let Buffalo-Springfield KT-8 roll within inches of side-obstructions . . . reduce or eliminate hand-tamping.

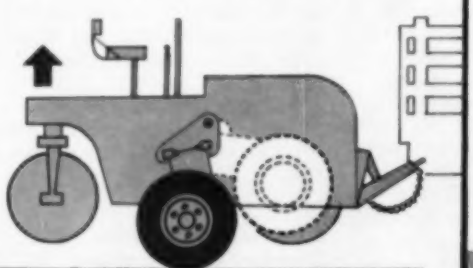
EXCLUSIVE!



To make change from work position to travel position, hinged towing wheels swing forward . . .



Hydraulic power applies down-pressure on wheels . . . lifts front-end to height of truck-hitch . . .



After hitch is secured, more down-pressure is applied till balance point is reached. That's all there is to it!

fold-away towing wheels on KT-8 roller let you work closer to side-obstructions... make faster job-to-job moves

Towing wheels on the 4-6 ton KT-8 roller *fold away* — and *out of the way* — into main frame. Gives operator a clear view of his work. Lets him roll within *inches* of abutments, poles, buildings, fences . . . without removing towing wheels. No other roller on the market offers you this advantage.

Raising and lowering action is hydraulically powered . . . eliminates need for blocking, and jacking. You switch from rolling to towing in a matter of *minutes*. Saves time, effort. Safer, too!

Learn more about this compact little workhorse. Write for tell-all specifications, or call Buffalo-Springfield® distributor. 83

BUFFALO-SPRINGFIELD COMPANY

SPRINGFIELD, OHIO (Division of Koehring Co.)

Also: FLAHERTY SPREADERS, SWEEPERS • STARDUST-KEYSTONE ROLLING MACHINES

STABILIZE UNPAVED ROADS KEEP DUST DOWN . . .

with Dow Calcium Chloride

PELADOW® (94-97% conc.)

DOWFLAKE® (77-80% conc.)

End the wasteful dust plague—complaints, too! Keep road surfaces intact; minimize gravel losses, blading costs! Dow calcium chloride stabilizes unpaved areas by absorbing, then holding moisture. Two types, pellet or flake . . . more economical in bulk.

Write for Kit on "Dust & Stabilization For Unpaved Roads".

DOW

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One man can gather most of the facts and, in the process, be indoctrinated in at least the basic training needed for electronic computation. A Royal-McBee LGP-30 computer is being used by Fay, Spofford & Thorndike, Inc., under a lease arrangement. FS & T set up a computation section which is permanently assigned to do all computation. The specific intent was to develop programming proficiency as fast as possible and, at the same time, to build up a library of basic programs. POOL, the LGP-30 users group, recently formed a group to facilitate the exchange of programs among members. In the future, the smaller engineering office may employ a service bureau to handle its computation work, or unite with other offices handling similar work and engage in a mutual computation program. One thing is certain, no engineering office, whatever the size, can afford to ignore the important developments being made in electronic computation.

"The Consultant and the Computer." By William T. Gay, Jr., Head of Computation Section, Fay, Spofford & Thorndike, Inc. *Consulting Engineer*, February, 1960.

The Use of Epoxy Resins

Spalled areas have appeared in the reinforced concrete bridge decks and concrete slabs at Interchange Plazas and Service Areas on the New Jersey Turnpike. Two products of similar material were used to repair the damaged areas. One material was an epoxy patching compound consisting of a two component epoxy resin with the aggregate to be added by the user. The second product consisted of a two component epoxy resin with aggregate and emery particles which provided a suitable dressing for anti-skid protection. The first step in the repair is to remove all loose particles of concrete by means of a small chipping hammer. The next step is to blend the two components of the epoxy resin by means of a small portable electric drill with wire paddles. The surface to be patched must be primed with the mixture by means of a paint brush. To the balance of the mixture was added dry, manufactured sharp stone sand or silica sand. The mixture was again mixed until it became stiff and then it was applied to the spalled area and troweled to a smooth surface finish. Sharp sand or emery particles were added to the finish to give a non-skid quality. The second product is used in the same manner with the exception that the manufacturer has provided the aggregate in addition to the epoxy resin material. Both products are unharmed by freezing temperatures before or after use, are quick setting, waterproof, abrasion and chemical resistant. A four man crew accomplishes the patch work with about 15 to 20 patches being completed per day.

"The Use of Epoxy Resins on the New Jersey Turnpike." By Harold W. Goldberger, Assistant Engineer of Maintenance, New Jersey Turnpike Authority. PUBLIC WORKS, March, 1960.

Business District Improved Pay Off-Street Parking

St. Albans, Vt., (population 9,000), has built new off-street parking facilities to upgrade its business district. In 1955, the Mayor and City Council realized that if the downtown business area were to retain its attractiveness, the city would have to provide more parking spaces for the shoppers and the tourists. The Mayor appointed a citizens' study committee to investigate the problem. The committee recommended that the first lot be located in the center of the largest and busiest business-area block. The city council responded by purchasing the property (8,935 sq. yds.), financing it by the accumulated on-street parking-meter revenue. In the fall of 1958, the city awarded a contract for $23,607 to pave the lot. The specifications were as follows: A 4-in. bank-run gravel base; a second course of 2-in. crusher gravel, compacted; a 2½-in. layer of bituminous concrete in two courses, machine spread and compacted; concrete meter bases; 150 feet of concrete sidewalk; 658 lineal ft. of bituminous concrete curbing; and drainage pipe, and a 4 x 12-in. catch basin and grate. An additional $6,000 was spent by the city for demolition, legal and engineering fees and miscellaneous items. Four GE 23,000-lumen fluorescent lamps on two 30-ft. Hubbard aluminum standards provide lighting. A total of 32 spaces are limited to two-hour parking and 68 spaces have been reserved for all-day parking.

"Off-Street Parking." By John M. Simmons, City Manager, St. Albans, Vt. *The American City*, February, 1960.

California Revises Its Standard Specifications

In California the contractors will be working under a new edition of

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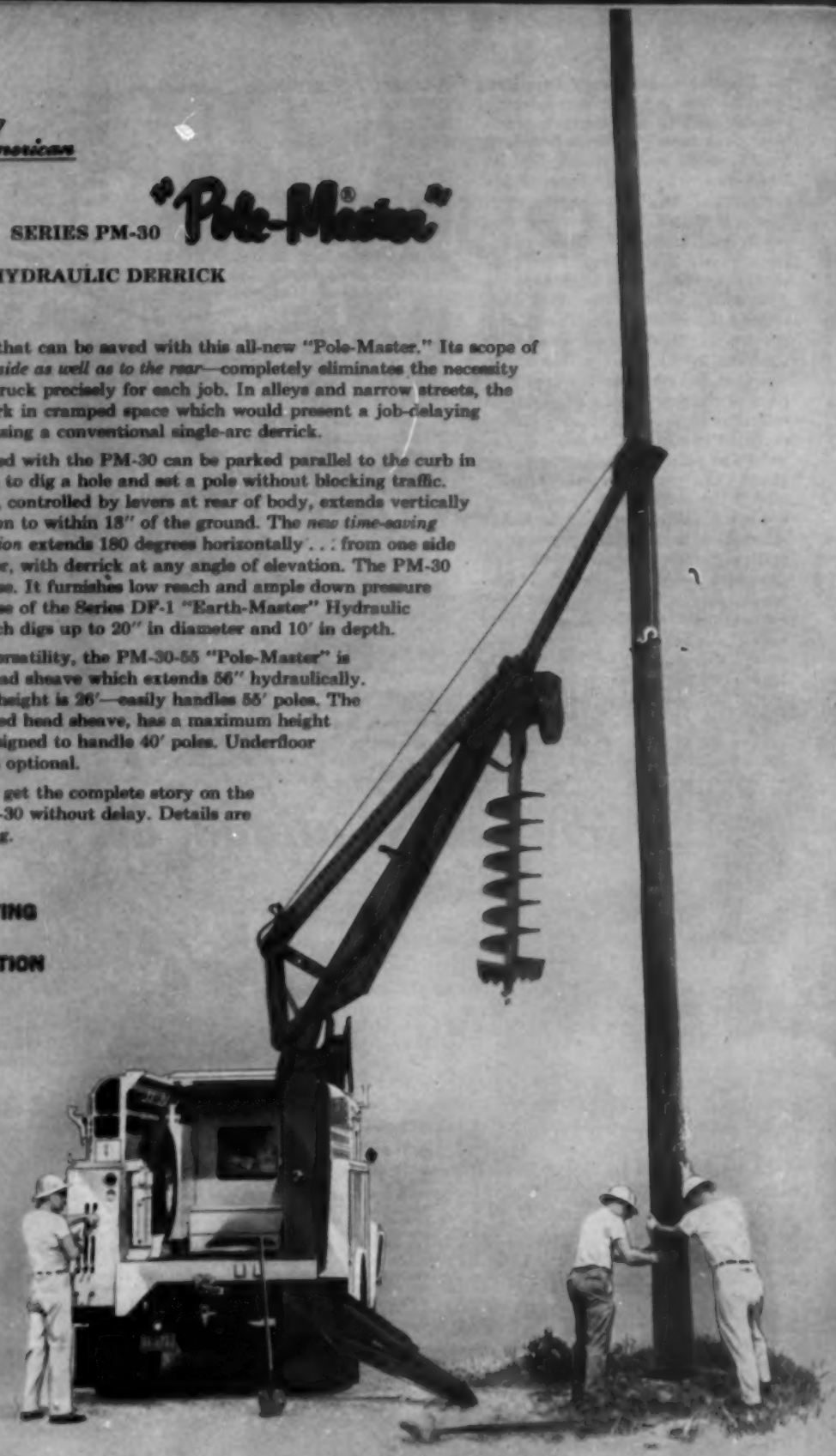

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the Division of Highways' Standard Specifications. A permanent working committee was appointed to consider revisions of the Standard Specifications and Standard Special Provisions, with each interested department of the division represented. The committee felt that an end result specification would be satisfactory only if a test could be made within a short period of time to determine whether the product conformed to specifications. Where any portion of the general provisions applying to all items of work was repeated in certain subsequent sections of the specifications relating to rejection of unacceptable work—or repeated in suspending work due to failure to perform any contract provision—the repetition was eliminated in the revision. Sections revised are as follows: changes in the work; alternative equipment; prosecution and progress; measurement and payment; surplus excavation disposal; structure excavation; ditch excavation; free haul; aggregate bases; asphalt concrete; Portland cement concrete pavement; Portland cement concrete; concrete curbs and sidewalks; and concrete structures.

"California Revises Its Standard Specifications." By L. D. Wanee, Assistant Construction Engineer, California Division of Highways, Sacramento, Calif. *Roads and Streets*, January, 1960.

Other Articles

"**Latex-Cement** Road Surfacings." Natural rubber as a binding medium. By E. G. Rawlings, Technical Adviser, Industrial Div., Semtex Ltd. Contractors Record and Municipal Engineering, January 20, 1960.

"Use of **Asphalt Bases** in Germany." By Dr. Herbert Schmidt, Head of the Asphalt Laboratory of ESSO, Hamburg. Roads and Road Construction, December, 1959.

"Modern Aids to Highway Planning." **Air photography combines with the computer** in assisting the civil engineer. Highways and Bridges and Engineering Works, January 20, 1960.

"Oak Park Is Ready for Snow." City purchased an old bus and converted it into a quick-loading, continuous spreading unit capable of **handling bulk salt.** By Frank R. Smiley, Assistant to the Village Manager, Oak Park, Ill. PUBLIC WORKS, March, 1960.

"Baltimore County Establishes **Urban Highway System in Rural Areas.**" The tools offered by farsighted planning and sound engineering are enabling those responsible in Baltimore County to bring a new system into a rural area in an organized manner. By Albert B. Kaltenbach, Director, Baltimore County Dept. of Public Works, Towson, Md. PUBLIC WORKS, March, 1960.

"**Outstanding Park** Is Gift to Boise." By Gordon S. Bowen, Park Supt., Boise, Idaho. Park Maintenance, February, 1960.

"A Handbook for Highways." In addition to a report on its stewardship, Wisconsin State Highway Commission's biennial report is an **informative highway handbook** for all citizens. By Harold J. Roche, Chief of Public Information, Wisconsin State Highway Commission. Better Roads, January, 1960.

"An **Arterial Gets Face-Lifted** and Widened." Denver's busy Colorado Blvd. has been restored physically and its traffic capacity greatly increased. By H. K. Glidden. Civil Engineer. Street Engineering, February, 1960.

"**Parking Garage** Makes Hit With Women Shoppers." Tucson's new 370-car self-service parking facility was designed with special thought to pleasing the ladies. Cantilevered exterior exit ramp a unique feature. By Herman L. Danforth, Director of Public Works, Tucson, Ariz. Street Engineering, February, 1960.

"**More Motorways**, But Who Designs Them?" Britain is working furiously on a new network of motorways, dual carriageways, flyovers and roundabouts. The consulting engineer is hanging onto, even increasing, his share of the design work. By The

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Economist, Intelligence Unit Ltd. Consulting Engineer, February, 1960.

"Why Let the Low Bidder **Fix Your Fee?**" By Donald R. Goodkind, Goodkind & O'Dea. Consulting Engineer, February, 1960.

"Improved **Quality of Concrete** May Be Answer To Winter Salt Damage." By R. F. Legget and E. G. Swenson, Div. of Building Research, National Research Council, Ottawa. Roads and Engineering Construction, February, 1960.

"Canada's First Major Use of **Wire Fabric in Asphalt.**" Better Roads, January, 1960.

"Glaciers Are Still Making **Trouble for Highway Engineers.**" Glaciers, which at one time covered nearly half of North America, are still creating large problems for highway and bridge engineers, after many thousands of years. Especially in the Red River Valley in Minnesota where bridges often need adjusting. By Howard Q. Owen. Better Roads, January, 1960.

"Practice Sum-Up: **Subbase for Concrete.**" Getting quality construction is one of a series. By John D. Geesaman, Field and Laboratory Studies Engineer, Portland Cement Association. Roads and Streets, January, 1960.

"**Efficient Subbase Routine** Meets Ohio's Exacting Specs." Roads and Streets, January, 1960.

"Meeting Today's **Highway Fill** Requirements." Sometimes there is no easy way, as shown on this glacial soil project in northeast Ohio. Roads and Streets, January, 1960.

"Production Analysis of a **Hot-Mix Plant.**" A stop-watch study can spot causes of delays or slow-downs and pinpoint plant bottlenecks. By R. L. Peurifoy. Roads and Streets, January, 1960.

"Progress Report, **Highway Compaction Control.**" By H. A. Radzikowski, Chief, Div. of Development, Office of Operations, Bureau of Public Roads, Washington, D. C. Roads and Streets, January, 1960.

"**Paving Most People Can Afford.**" By Neal McRae, Street Supt., Birmingham, Ala. The American City, February, 1960.

"**Wet Rotary Pre-Excavation For Piles.**" By Lindsey J. Phares, Vice-President, Raymond Concrete Pile Co., Div. of Raymond International Inc., New York, N. Y. Civil Engineering, February, 1960.

"**County Problems** Are Same on Both Sides of Border." At least, the problems that beset Welland County, Ont., do not differ except in detail from those of hundreds of counties in the United States. Some of the chief problems are lack of public relations and money, load restrictions, inadequate bases and drainage. By W. J. Smith, County Engineer, Welland County, Welland, Ont., Canada. Better Roads, February, 1960.

"Southeast's First **Slip-Form Job.**" A 5.6-mile bypass on U. S. Route 1 around Moncure, N. C., paved with slip-form paver. Better Roads, February, 1960.

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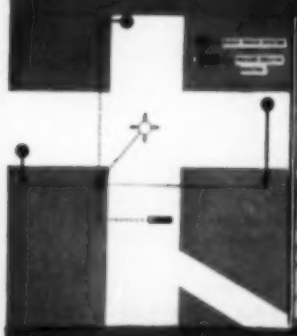

5. New "zero cross over impulse" feature permits ED-2 to be used in combination with existing pressure detectors on same traffic phase.

6. Radar Detectors may be mast arm mounted on existing wood or steel poles using standard luminaire-type mast arms.

7. Mounted on rigid 2-wire span, one or more Radar Detectors can be suspended in position without for other detectors and mountings.

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AUTOMATIC SIGNAL DIVISION

EASTERN INDUSTRIES, INC. • NORWALK, CONNECTICUT

CRITERIA for OFF-STREET PARKING

WILLIAM MARCONI
Assistant City Traffic Engineer,
San Francisco, California

AFTER a long trial and error process, San Francisco's Division of Traffic Engineering has evolved what it believes to be a workable set of standards for judging the feasibility of off-street parking space required under San Francisco's "one-for-one" parking ordinance. The ordinance, requiring one parking space for every new or rebuilt living unit constructed in San Francisco, gave the Department of City Planning the burden of enforcement without, however, developing any set of standards other than stating that 160 sq. ft. would be required for each parking space. When City Traffic Engineer Ross T. Shoaf was asked for advice, he developed a template type of analysis as the basic standard, which seems to work quite well. It allows building designers to lay out off-street parking space with a set of standards that will cover any situation.

Early Standards

Because the Bureau of Engineering contained a Traffic Engineering Division, the Bureau was called in to act as the consulting unit for the Department of City Planning. It was asked to judge if parking spaces provided by architects and builders were actually valid parking spaces that could and would be used by future tenants. While even very tight parking spaces can be entered by most automobiles if motorists are willing, it is evident that if an off-street space is too difficult to enter or has the possibility of being blocked, the motorist will more often than not tend to leave his car in the street, thus defeating the purpose of the ordinance.

The first standards tentatively used by the traffic engineers were a modified form of the parking layout shown in the Bureau of Public Roads Parking Manual. They provided for 8 x 18-ft. car spaces with 24-ft. aisles for right angle parking. It soon became evident that these standards were not applicable to this problem for the following reasons:

1. The standards appeared to be too strict for locations where people use the same stalls day after day. Generally speaking, the standards provided that all cars could enter the stall in one maneuver which is not really necessary for a driver who is familiar with a parking stall.

2. There are too many situations where standards such as this could not be applied; i.e., apartment houses or private dwellings with one, two, three, four or five parking spaces.

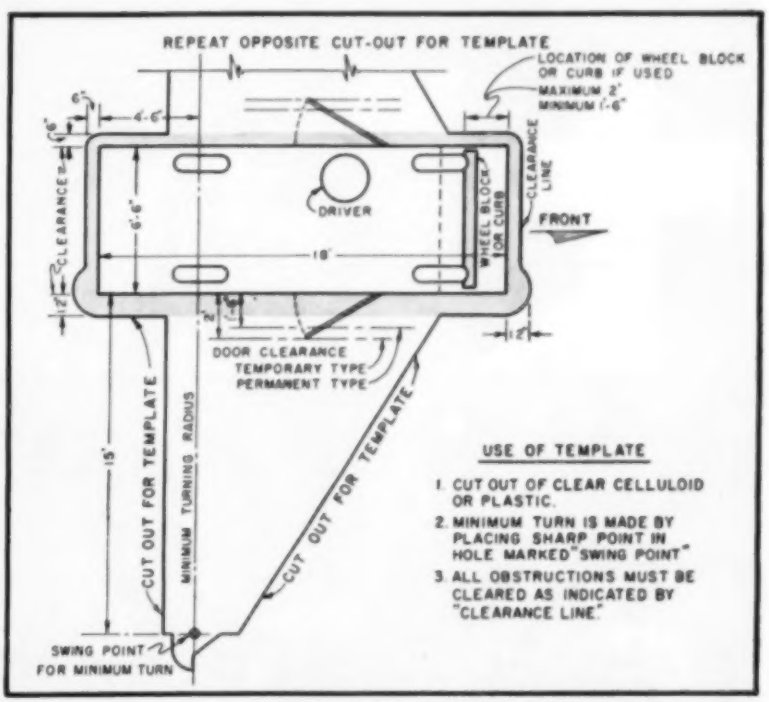
3. The standard did not take into account many factors which were of considerable importance, such as where obstructions, including posts and pillars, would be located in relation to the parking stalls. In maneuvering into a stall, a vehicle often encroaches onto the edges of the adjoining stall. The presence of a post or pole at the end of a stall will prevent this encroachment and so make maneuvering and entering the stall much more difficult.

Analysis of Stall Adequacy

After some experience with the problem, it was decided to develop a set of standards using an automobile template as the basis of analysis. The standards are shown on the accompanying drawing. The design automobile is 6½ x 18 ft., with a 15-ft. inside turning radius. These dimensions cover most of the small and medium size cars. However, the turning radius is as large as that of the larger cars.

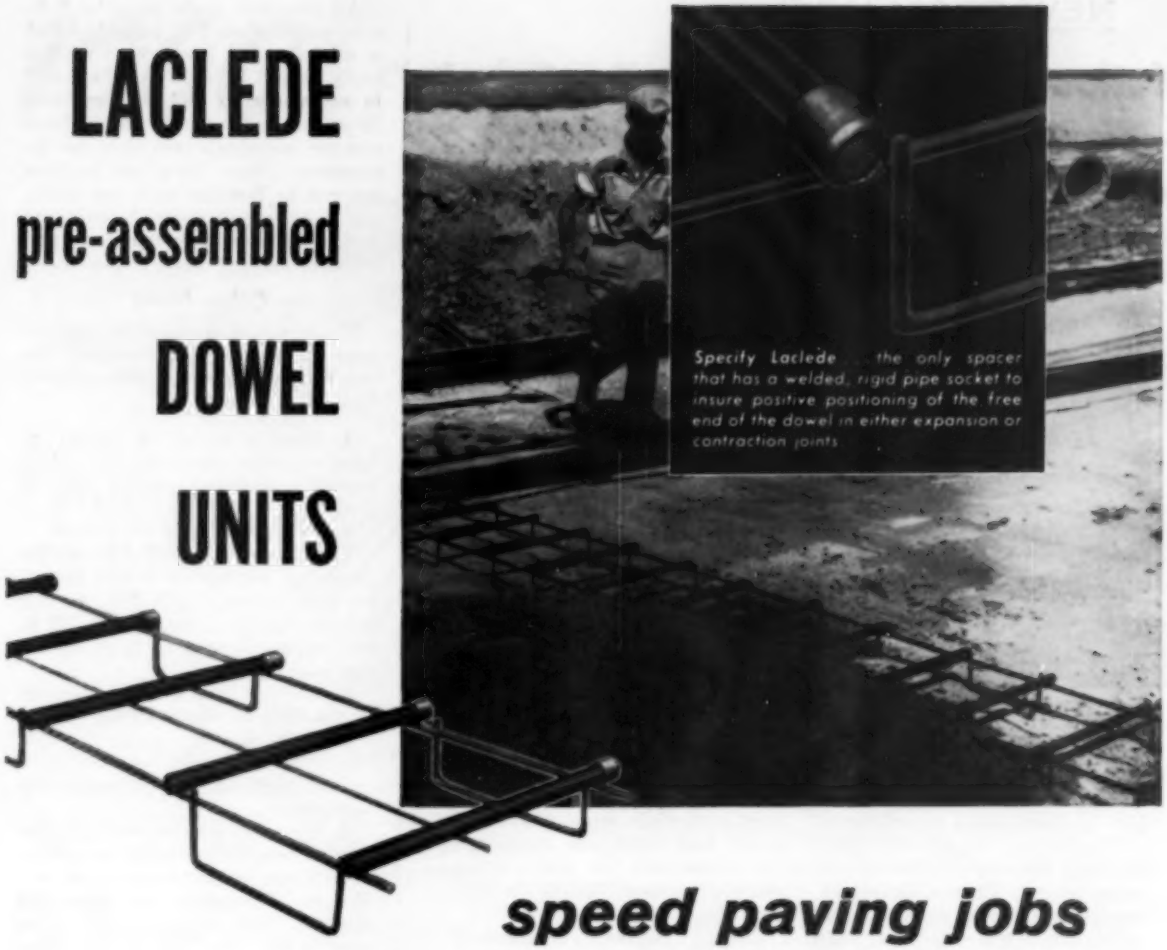
For permanent parking, which is either apartment or home type parking, it is required that the template shown in the drawing be able to be maneuvered into each stall and that at least 50 percent of the stalls be entered in one maneuver. (One maneuver is a direct drive into a stall without any stops involved. It may include turning of the wheels, however.) The other 50 percent may be entered in either two or three maneuvers with the restriction that no more than 20 percent of the stalls require three maneuvers (two maneuvers is the back-in type parking and requires one stop; three maneuvers is basically making two passes at a stall, and requires two stops). The clearances shown on the drawing, 6 in. on the driver's side and 1 ft. on the blind side, must be observed when maneuvering into a stall. It is assumed while testing any stall that all other stalls are filled.

Transient type of parking such as is found in motels and hotels is treated in the same manner as permanent parking with two exceptions:



● **TEMPLATE cut to ¼-in. scale is used by San Francisco Traffic Engineering Division to check the size and accessibility of proposed off-street parking space.**

LACLEDE pre-assembled DOWEL UNITS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All transient stalls must be 8 ft. 6 in. rather than 8 ft. in width; and a minimum of 80 percent of the stalls should be able to be entered in one maneuver and the remaining 20 percent in two maneuvers. These stricter standards are felt to be necessary since transient parkers are not as familiar with the parking act in a strange location as people who live in an apartment and who are parking there regularly.

Other Items

There are a number of supplementary points in the standards beside the basic template maneuvering that must be met:

1. When a vehicle is parked, at least one door should be able to be opened a minimum distance of 1 ft. 6 in.
2. No blocked stalls are allowed.
3. Minimum entrance and exit widths depend on the number of cars parked. For three or less, this is 8 ft., for four through ten, 9 ft., ten to fifty, 10 ft. and fifty-one or over, 20 ft. or two 10-foot exits.
4. Minimum lane widths correspond to the entrance width standards.
5. Stalls fronting on the sidewalk have to be a minimum length of 20 ft. so that larger cars will not usurp sidewalk space.
6. If over 25 vehicles are parked inside an area, a turnaround space must be provided so that numbers of vehicles will not have to back across the sidewalk. Also, a vehicle should not have to back over 110 ft. after leaving the stall.
7. Maximum ramp grades are set at 25 percent with adequate transition sections.

These standards seem to work quite well in San Francisco. It is possible that stricter standards might be desirable in a community with small population densities, but that, of course, is a matter to be determined by judgment and experience.

• • •

Volume of Refuse and Handling Data

The Department of Public Works of Tenafly, N. J., reported 39,323 cu. yds. of refuse. Trailer loads to the Bergen County landfill numbered 1,142. Required time for loading was 3,318 hours; for trips 2,584 hours; for maintenance of equipment 776 hours; for maintenance of grounds 3,681 hours. Total man-hours amounted to 10,515. Cost of refuse disposal was $38,867.57.

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Public Works Engineers and Administrators

The 1960 Public Works Congress and Equipment Show promises to be one of the largest ever sponsored by the American Public Works Association. This means that public works engineers and administrators benefit in several ways; first of all from the many technical sessions that will be set up covering a wide range of topics. But just as important will be the opportunity to examine under one roof the latest materials, equipment and supplies available to the public works field. It's the show you can't afford to miss.

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Mott Corporation
Tarrant Manufacturing Co.
International Incinerators, Inc.
Air Placement Equipment Co.
Massey-Ferguson Ind. Div.
Newark Brush Company
R. E. Dietz Company
Fox River Tractor Co.
Wisconsin Motors Corp.
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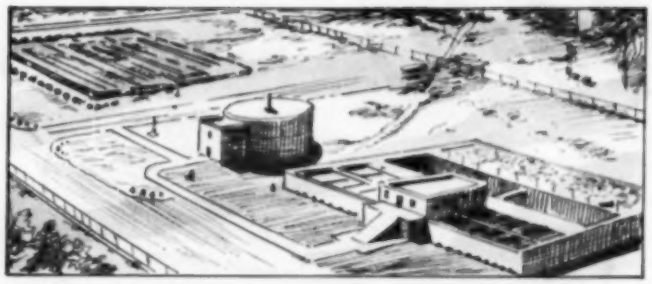


Prepared by **ALVIN R. JACOBSON, Ph.D**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

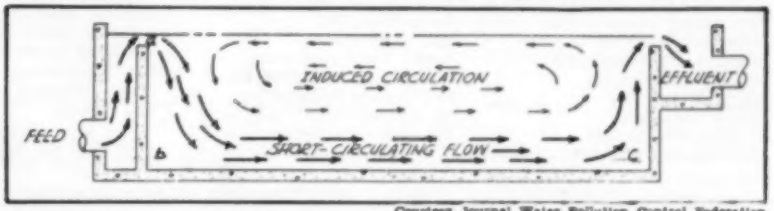
Clarifier Feedwells

This paper deals with the problem of density-current short-circuiting in clarification basins. As a suspension passes through a settling basin it loses settleable solids which are heavier than the suspending liquid. Therefore, when new feed is introduced into a basin of partially clarified liquid it tends to plunge to the bottom as a "submerged waterfall" and to spread out as a heavy density layer beneath the lighter supernatant. The density current so produced traverses the basin and is deflected upward against the effluent wall. Of course the current does lose velocity in traversing the basin, but there are two factors which counteract the loss. First, the density decreases through loss of some of the suspended solids as the current traverses the basin. Second, a density current in practice does not derive its velocity solely from subsidence. A substantial part is residual feed-stream velocity which is not dissipated by the feedwell structures. As a result, even though there is substantial loss of velocity, the current can still short-circuit to the overflow weir. There are two alternative and fundamentally different approaches to preventing formation of such a short-circuiting flow pattern. One is the hydraulically effective "pipe-line" approach in which the basin is made shallow, narrow and long enough so that the flow tends to traverse the basin with a minimum of dispersion or short-circuiting. The alternative means of minimizing short-circuiting is to reduce all flow velocities sufficiently so that hydrostatic stratification prevails. The main difficulty in establishing density stabilization within clarification basins lies in dispersing the velocity of the input stream. Theoretically, there are three ways to cope with the input velocity: 1) Convert the corresponding energy of the feed stream to head; 2) extract it as work; or 3) dissipate it as hydraulic loss. Nearly all feedwell structures are intended to cause irreversible dissipation of the input energy as hydraulic loss. The author discusses the various conventional expedients and a new type of feedwell to establish density stabilization. A number of diagrams of the various feedwells and their effects on short-circuiting are provided in this article.

"Feedwells For Density Stabilization." By E. B. Fitch and W. A. Lutz, Director of Westport Laboratories and Manager, Process Engineering, Plant Design Division, Dorr-Oliver Incorporated, Stamford, Conn. *Journal Water Pollution Control Federation*, February, 1960.

Sewerage Improvements Protect Beaches

Principal among the assets of Asbury Park, N. J. are the popular bathing beaches and adjacent recreational areas. Their proximity to the municipal sewage treatment plant makes it mandatory that the plant be not only ample in capacity but also of modern design with careful operation and maintenance. With the completion of current construction, which is the second and final stage of a program started several years ago, the sewage treatment facilities will be modern, of capacity suited to serve future population projections, and conforming to the requirements of the State Department of Health. The new intercepting sewer, replacing a sewer that was more than 50 years old, is of Johns-Manville asbestos cement and ranges from 16 to 30 inches in diameter. The enlarged treatment plant has a design capacity of 5.5 mgd average flow. The sewage from the new 30-inch intercepting sewer and the relocated 18-inch sewer is discharged into a common manhole in front of the sewage treatment plant where chlorine is added for odor control. The sewage is then directed to grit chambers where the grit particles fall through perforated plates into hoppers. Grit is removed from the hoppers by air lifts and conducted through separator pipes to grit cans. The cans are removed by the existing screening hoist for disposal. Sewage leaving the grit chambers is screened and shredded by one of two Chicago "Barminutors" and then pumped to one of eight rectangular, covered primary settling tanks, each equipped with Link Belt sludge and scum collectors. The settled sewage is discharged into concrete contact tanks where chlorine solution is applied for disinfection of the sewage. The chlorinated settled sewage can flow by gravity, during periods of low tide, through the 18-inch ocean outfall sewer extending more than 1,000 feet off shore, or be discharged under pressure by three Fairbanks-Morse pumps. The sludge and scum are then pumped to one of the two new



Courtesy Journal Water Pollution Control Federation

● **DENSITY currents may occur in a settling basin due to the greater specific gravity of the incoming flow. Alternatives are discussed in "Clarifier Feedwells."**

"Controlled Digestion" Additions at Oakland

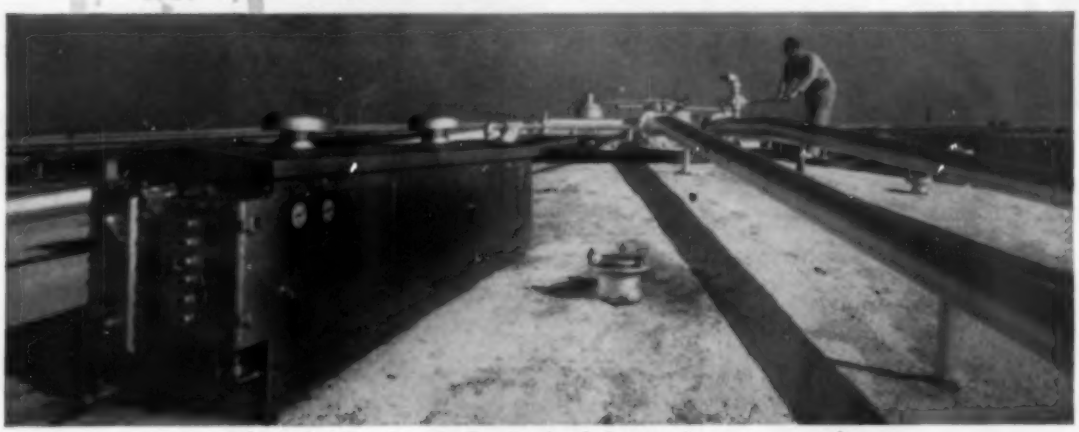
California's East Bay Municipal Utility District has made commendable steps in their clean-up program to curb pollution of the San Francisco Bay.

Their sewage treatment plant was completed in 1951 and included the following P.F.T. equipment: three 95′ Floating Covers, three #1500 Heaters and Heat Exchangers, three Floating Cover Position Indicators, Gas Safety Equipment.

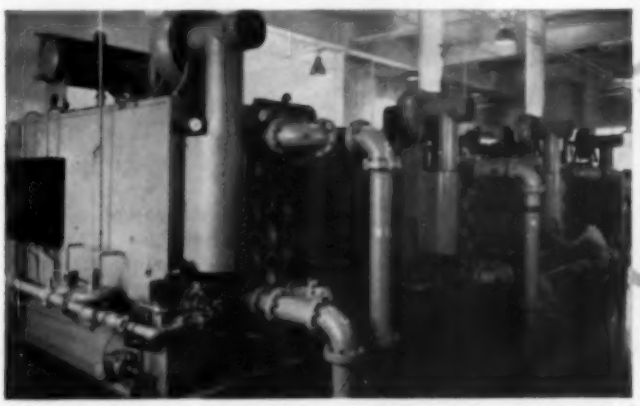
Continuing their program, in 1958 P.F.T. equipment was *again* selected which included: one 95′ Floating Cover, another #1500 Heater and Heat Exchanger and a Floating Cover Position Indicator.

1958's additions embodied all the latest digestion controls including P.F.T. Pearth Gas Recirculation for increased effectiveness of the new unit.

Plant designed by—Engineering Department—East Bay Municipal Utility District.



Above—P.F.T.'s Pearth Gas Recirculation equipment on newly added 95′ P.F.T. Floating Cover Digester.



Above—Additional P.F.T. Heater and Heat Exchanger installed in 1958. Notice the perfect blending with those installed in 1951.

P.F.T.

waste treatment equipment exclusively since 1893

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sludge digestion tanks, one of them being equipped with a Pearth gas recirculation system. The total cost of the improvement program is in excess of $1,150,000.

"Sewerage Improvements Protect Beach Resort." By Kendall H. Lee, City Manager, Asbury Park, N.J. PUBLIC WORKS, March, 1960.

Electronic Hardware

Future design trends for sewage treatment and pumping facilities will undoubtedly include the provision of more and more automation for more economical and reliable operation. "Automation may be defined as the automatic control of a sequence of events in an orderly, predetermined fashion. In addition, the results obtained are automatically measured and used to provide corrective control action as required to maintain the results within specific limits." The term automation includes the following precepts: 1) Operation is automatic; no manual attention is required. 2) Operation sequences are orderly, self-checking and usually fail-safe. 3) Operation is self-regulating, or correcting, based on measuring desired significant system parameters. The "tools" of automation, although they may often seem to be complex and difficult to understand, are basically made from combinations or modifications of a few relatively simple devices. It is not the author's intent to give a complete analysis of these devices, but rather to describe in simple language what they are, how they work, their good features and their limitations. As a further restriction, data are confined to devices which are electrical in nature. They include magnetic amplifiers, transistors, controlled rectifiers and other deviecs, including electron tubes and magnetic tapes. After a description of the basic electrical automation devices, the author proceeds into a discussion of how these devices can be combined and applied in practical pieces of equipment and apparatus to do useful sewage works jobs. These include static logic elements and sensing and protective elements.

"Electronic Hardware Makes Sewage Works Automation Click." By R. E. Treffeisen, Application Engineer, Industrial Control Dept., General Electric Co. *Wastes Engineering*, February, 1960.

Turbine Aeration

Evaluation of the data derived from commercial-scale operation of turbine aeration studies conducted at six sites on three different rivers in Wisconsin during 1958 have provided the following conclusions: 1) Turbine aeration appears to be a practical means of adding oxygen to waters low in dissolved oxygen which are passing through suitably located and designed hydroelectric power installations. 2) Where turbines are so located as to be able to process oxygen-deficient waters (40 percent saturation or less), practical amounts of oxygen were found to be absorbed at rates ranging from 1,600 to 8,200 lb. 0, per 1,000 cfs of stream flow per day at summer temperatures in excess of 20° C. 3) Oxygen-absorption efficiencies ranged from 15 to 35 percent in five of these commercial-scale tests receiving extended study. 4) Turbine aeration results in loss of power production, as judged by direct panel meter readings, from 2.5 to 10.6 percent. 5) Average values of from 1.8 to 5.6 lb. oxygen were found to be absorbed for each kwh of power loss. 6) If firm power is valued at 1¢ per kwh, the cost of aeration by this method appeared to be in the range of $3.00 to $15.00

IF YOU DON'T HAVE A TRUCK-LODER
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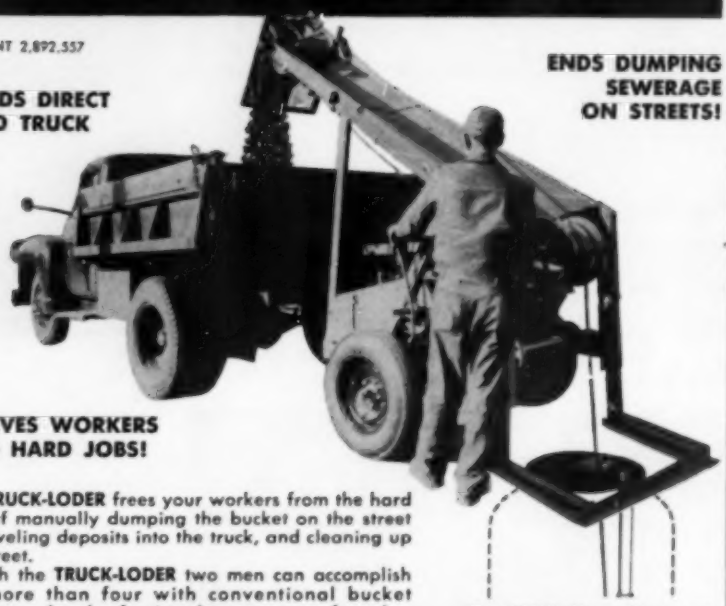

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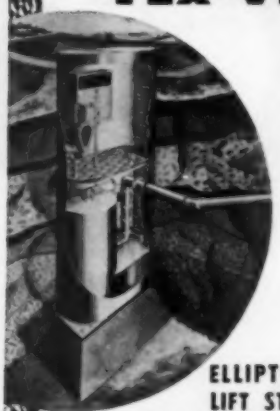

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Elliptical-shaped outer shell completely encloses the air storage tank and sewage receiver of this simplex sewage ejector station. This unique design provides maximum protection for all components — plus easier maintenance and modification. Any component can be removed and replaced without removing the outer shell.

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INSTALLATION TESTED AND PROVEN
Ellipto-Ject pneumatic ejector stations are setting new standards. Names of municipal and industrial users on request.
Let Tex-Vit help with all your sewage lift problems. Tex-Vit also manufactures Delta-Ject, a duplex station incorporating the same design principles as the Ellipto-Ject. Other Tex-Vit products include pneumatic ejectors and packaged pump stations.

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per ton of oxygen absorbed. Turbine aeration is expected to continue in Wisconsin, Minnesota and Michigan and in Germany and it is hoped that the various data can be brought together in the near future to help in further development of the design and operating problems observed and anticipated in turbine aeration.

"Commercial-Scale Operation of Turbine Aeration on Wisconsin Rivers." By A. J. Wiley and B. F. Lueck; and R. H. Scott and T. F. Wisniewski, Respectively, Sulphite Pulp Manufacturers Research League, Appleton, Wis.; and Wisconsin Committee on Pollution, Madison, Wis. *Journal Water Pollution Control Federation*, February, 1960.

Nation's Largest Incinerator

In 1955 the City of Chicago embarked on a long-range incinerator-construction program. The Medill Avenue plant was the first one constructed; this went into service in 1956. The Calumet plant is the second of four scheduled for construction and is the largest built so far in the United States. It contains six furnaces each rated at 200 tons per 24 hours and each divided into three cells with individual charging and ash removal. Three 5-ton P & H cranes transfer refuse from the 1200-ton-capacity storage pit to the various charging hoppers. Hydraulically-operated inclined Flynn & Emrich stokers agitate the refuse as it burns. A 250-ft. chimney serves each pair of furnaces. Large subsidence chambers and a spray chamber with a wet bottom assure elimination of the fly ash to meet the city's air pollution control requirements. Independent air pollution tests were made by a private testing laboratory to determine the effectiveness of the equipment for the removal of flyash. The results exceeded expectations. The design capacity of 200 tons per 24 hours for each furnace was based on a mixed refuse consisting of 46% combustible, 15% moisture, and 39% noncombustible. Chicago's refuse averages 400 to 500 pounds per cubic yard and 4,000 BTU's per pound.

"Calumet Incinerator—Chicago's Second, Nation's Largest." By R. H. Stellwagen, Consulting Engineer. *The American City*, February, 1960.

Reidsville, N. C., Sewage Plant

When Reidsville, N. C., was faced with a major sewage problem in 1953, it inaugurated a $1,150,000 sewage collection system and treatment plant improvement program, which took three years to complete. The key to the program was a new 3 mgd high rate trickling filter plant. Other construction included three pump stations, improvements to an existing pump station, and necessary outfalls, interceptors and force mains. Treatment facilities included a bar screen, grit chamber, primary sedimentation tanks, high rate filters, final settling tanks, chlorine feed equipment and contact tanks, sludge conditioning tanks, digesters and sludge drying beds. A unique system of control of recirculation based on sump level rather than plant influent rate of flow is a feature of this new plant as it provides a more simple and economical arrangement. Such control is provided by use of a Foxboro Stabilog indicating level controller. This instrument, together with a bubble tube measuring element, keeps sump level at a set point by operating an 18-inch butterfly valve in the recirculation line from the final sedimentation tanks. Five reinforced concrete final sedimentation tanks and chlorination facilities follow the filters and provide the final phase of the treatment process.

"Reidsville, N. C. Trickling Filter Plant." By E. J. Moglnicki, Piatt & Davis and Associates, Consulting Engineers. *Water & Sewage Works*, February, 1960.

Other Articles

"Another County Operates A **Sanitary Landfill.**" How an unorganized county refuse disposal site, operated without plan and harboring many rats, was converted to a sanitary fill. By Pat Thomson, County Engineer, Douglas County, Waterville, Washington. **Public Works**, March, 1960.

"Setting Fair **Sewer Service Rates** For Sewage and Industrial Wastes." Allegheny County's new treatment plant will be financed by revenues from 70 communities and complex factory discharges. By John F. Laboon, Executive Director, Chief Engineer and R. J. Dougherty, Chief Construction Engineer, General Superintendent of Operations, Allegheny County Sanitary Authority, Pittsburgh, Pa. **Wastes Engineering**, February, 1960.

"Technology and Economics of **Household Sewage Disposal** Systems." The principal conclusions of this comprehensive report are that an intensive research and development program to advance the technology of sewage disposal for metropolitan fringe areas is needed and until such time as the results of this program have become firmly established, con-

servative, time-proven sanitation objectives should be vigorously maintained in these areas. By Harold A. Thomas, Jr., James B. Coulter, Thomas V. Bendixon, and Allen B. Edwards. Respectively, Professor of Civil and Sanitary Engineering, Harvard University, Cambridge, Mass.; Senior Sanitary Engineer, Soil Scientist and Senior Assistant Sanitary Engineer, Suburban Sanitation Studies, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Journal Water Pollution Control Fed., February, 1960.

"Aeration In The **Activated Sludge** Process." Plants with much higher oxygenation capacities possible. A series of three articles. By A. L. Downing, M. A., B. Sc., Water Pollution Research Laboratory. Contractor's Record and Municipal Engineering, Jan. 20, 27, and February 3, 1960.

• • •

Bearing Temperature Control for Pump Station

Water for Montclair, N. J., comes through a 74-in. aqueduct from the Wanaque Reservoir to three water service areas through two pumping stations. Both pumping stations in the system in the past have required constant supervision.

Only one station (Watchung Avenue) is now manned—the second pumping station (Grove Street) is remotely controlled. This economical arrangement was obtained by protecting the pumps automatically from overheating damage, plus the remote transmission of all instrument measurements from unmanned Grove Street station to a supervisory control panel at Watchung. This effected an annual saving of $12,000.

A temperature monitoring system, the Thomas A. Edison Industries "Omniguard," provides continuous monitoring of motor bearing temperatures of each of the four pumping units at the remotely operated Grove Street station. If the temperature of any one of the 16 monitored points exceeds a predetermined set point, the pump unit is automatically shut down, preventing damage to the equipment.

Additionally, the remote control panel at the Watchung supervisory station permits starting and stopping any of the four pump units for the Grove Street station as well as control of the valves for each pump.

Fly Ash Sold by City Power Plant

It is reported that Cleveland, Ohio, is selling the fly ash produced by the city power plant, whereas disposal formerly cost about $30,000 per year; it is anticipated that an income of $10,000 will be derived from the sale.

Vacuum-clean Pavements

the EASY, LOW-COST *"City Slicker"* Way

Do you have the problem of picking up pedestrian dropped litter in your busy downtown street gutters? On parking lots, shopping centers, playgrounds? Then this compact, Jeep-mounted, **Tarco "City Slicker"** is your **most economical** answer.

The "City Slicker" cleans a 6½ foot path by means of vacuum and air power . . . no brooms or brushes to wear out or service. **Sucks** up and **separates** for quick handling: (1) all **kinds of light bulky litter:** newspapers, paper cups and wrappings, cigarette butts, tin cans; (2) dry **sand;** (3) light fine **dust.** Maneuverable and **safe** to operate in heavy traffic . . . maximum operator visibility. Dusty air cleaned in special air cleaners.

The "City Slicker" is **most economical.** The actual **operating cost is less than ¼ of the curb-mile cost of most other cleaning methods** . . . for every mile you use a "City Slicker" you will cut your present costs up to 75%. By using a "City Slicker" you **release your large power sweeping equipment** for more important dirt sweeping operations for which they are designed.

"City Slickers" are **now performing** money-saving litter collection work **in several large cities.** They can do the same for you. For details see your TARCO dealer or write to us.

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- **BORES**—with no surface break
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- **BORES**—so drill stem of pipe of conduit stays
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- **REAMS**—up to 12 inches diameter

Write immediately for information.

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LSU Tigers Now Have One Of the Nation's Best Lighted STADIUMS

TIGER STADIUM in Baton Rouge, La., home of LSU's outstanding football team, has been re-lighted with a new 8-tower system which is one of the finest in the nation. Sixteen Kerrigan low-alloy, high tensile steel standards, 90 feet tall, supporting a total of 572 floodlights, are mounted on top of the stadium. Specially constructed to withstand 125 mph winds, these continuous tapered, octagon shaped poles have bases that measure over 2½ feet in diameter.

The new floodlights hang 163 feet above the gridiron—47 feet higher than the old arcs which were installed in 1931. The old wide angle floods lighted the playing field but they hit sideline spectators' eyes too. Lighting on the field was not uniform, and "blind spots" made the pass receiver's job more difficult. Now the new narrow beam floods are directed down on the playing field and not in spectators' eyes. They give a uniform 115-foot-candle reading which is about five times greater than the old spotty 15 to 30 foot candles.

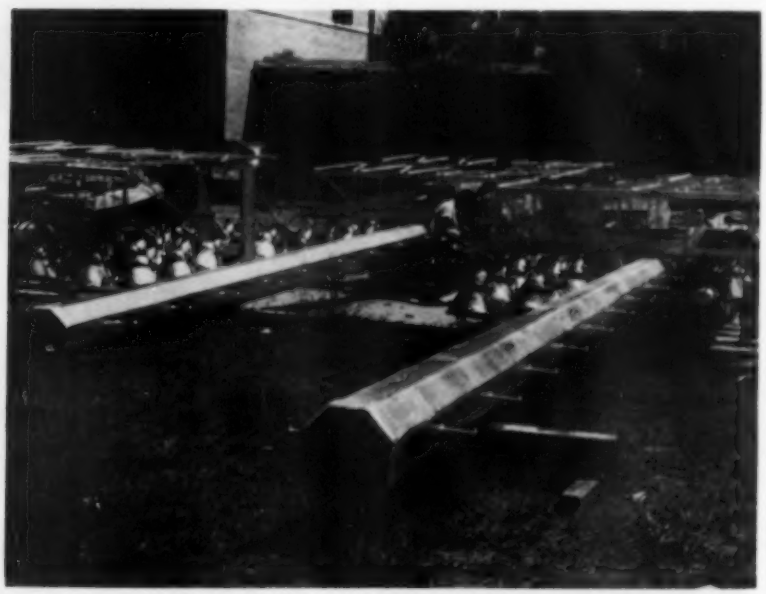
In the event of power failure on one tower, the other seven can carry the load. On the old system a power failure would mean four towers out of operation. As an added precaution, two individual feeder lines were installed from the power house to the stadium. In the event one line has mechanical failure, the alternate feeder line takes over for uninterrupted lighting.

● TOP section of pole, complete with platform and floodlights, is raised into position for slipping over lower section.

Each lamp unit was installed with precision by peep sight on center line of fixture. Each floodlight was spotted to a particular point so that the lighting was diffused and crossed, leaving no shadows on any section of the field. In fact, a football game can easily be played with only half of the lights in operation.

The new system was designed by W. H. Dyer & Associates, electrical engineering consultants, associated with Alfred G. Rayner & Associates for the structural steel work. Both are of Baton Rouge. The sixteen 90-foot steel standards, with special 22-inch bases and floodlighting platforms, were designed and manufactured by Kerrigan Iron Works Co., Nashville, Tenn. Curtis H. Stout Co., New Orleans, was Kerrigan's representative on the job. Appleton Electric Company supplied the floodlamps. Construction was by Sachse Electric Company, Baton Rouge. To install the big towers high on top of the football stadium, each standard was erected in two sections. First the lower half, 50 feet long, was hoisted in place, then plumbed up. The 40-foot top sections, with complete assembly of lights already installed on the ground, were then lifted and fitted into slip joints high in the air.

Thanks to $165,000 worth of lights, there is now real "seeability" at Tiger Stadium at night . . . from the standpoint of both the players and the fans.



● HERE IS a close-up view of the specially built poles as they are placed on the ground, with the floodlights and platforms attached ready for the final erection.

● ANCHOR base is provided atop the stadium onto which steel pole is placed.

POSITIVE CONTROL OF MATERIALS IN MOTION BIF METERS FEEDERS CONTROLS

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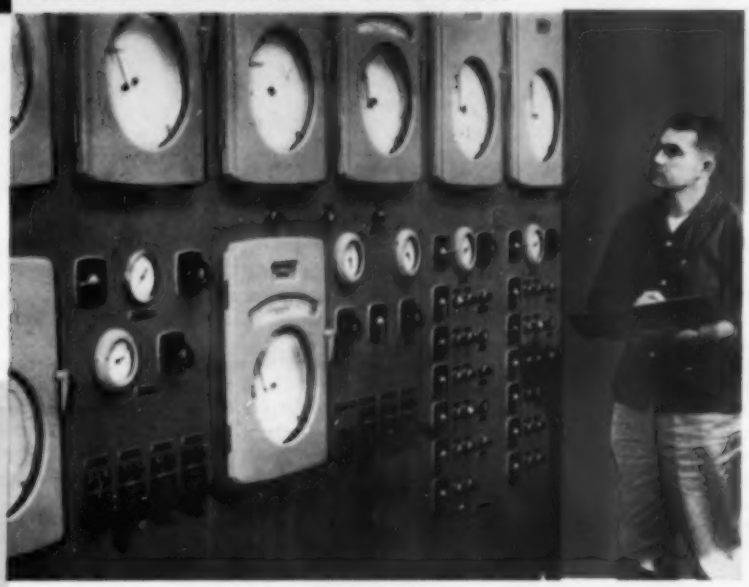

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Put your filter plant under push-button control . . . save time, money and increase reliability. One operator, pushing one button, starts the automatic sequencing of all valves in the filter backwash cycle . . . starts a high speed recorder which eliminates need for log entries and computations. Result: reduced operating time, elimination of human error, manpower released for more important duties.

System also permits economical arrangement of physical plant, lowers initial cost . . . automatically assures precise control of backwash cycle, provides reliability never possible with manual systems.

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Sanitary Fill Reclaims Valuable Land

TO PROVIDE space for its refuse dump, Bordentown, N. J., 18 years ago took over some 30 acres of swamp land. Over the next 13 years, 12 acres were brought to grade. As population increased in the area, this swamp land became more valuable as a site for refuse disposal and the filled portion acquired potential value as an area for light industrial and commercial installations.

When New Jersey passed a law prohibiting open dumps, Bordentown drew up a program for converting this area to a sanitary landfill. In preparing the plans, the City agreed to care for the refuse from the nearby Township of Bordentown, the Town of Mansfield and the Borough of Fieldsboro. In 1955, the city of Bordentown had purchased a Case model 500 crawler-loader and this formed the nucleus of the equipment for operating the landfill; but to handle the increased load and to aid in trenching, spreading, covering and compacting, it added a larger Case, a Model 1000 crawler-dozer with tilting blade.

Costs of operating the landfill are shared by the four communities on a per capita basis. The landfill now serves 16,000 people and handles an average of 300 truckloads a month. Refuse from a state reformatory and from a mental institution is also handled at the landfill.

To start the new fill, a trench 10 ft. deep, 40 ft. wide and 200 ft. long was excavated by the two machines. Dirt from this trench was used to cover and close up the old dump. A second trench was then started parallel to the first one and dirt from this is used to cover the refuse which is dumped and compacted in the first trench. When the first trench is filled and covered, the second will be ready for use in the disposal operation.

According to G. Edward Koenig, Mayor and Director of Public Works of Bordentown, the new landfill has been very satisfactory from both sanitary and cost standpoints. So far only two men are needed for its operation.

*THE NAME ORANGEBURG AND THE SILVER BAND ARE REGISTERED TRADE-MARKS OF THE ORANGEBURG MANUFACTURING CO.

Over 300 million feet in use coast to coast!

The test of time has proved the high quality of Orangeburg *Root-Proof* Pipe and Fittings for house sewer lines, downspout run-offs and other underground, non-pressure uses.

Orangeburg's Taperweld Joints seal root-proof and watertight. No leakage, no infiltration. And because it's made of a strong, tough non-metallic material, Orangeburg does not rust. Alternate freezing and thawing... acids and alkalies found in ground water and sewage do not affect it.

All these qualities plus speed, ease and economy of installation have gained for Orangeburg a growing acceptance among leading approving authorities, architects, engineers, builders and plumbers. Today, over 300 million feet of Orangeburg are in service from Maine to California.

The Silver Band* identifies *genuine* Orangeburg: *Root-Proof* Pipe for sewer lines; *Perforated* Pipe for foundation drains, septic tank disposal fields. Orangeburg exceeds requirements Federal Spec. SS-P-356 and Commercial Standard CS 116-54. Write Dept. PW-40 for Engineer's independent report.

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Division of The Flintkote Company, Manufacturer of America's Broadest Line of Building Products

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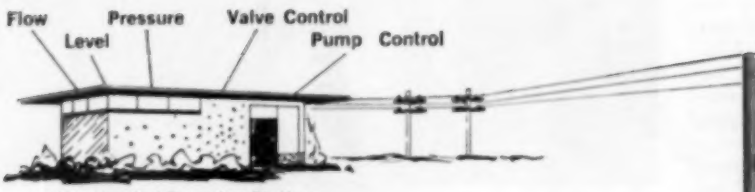
Root-Proof Pipe and Fittings

FLUIDICS* AT WORK



Unattended Pumping Station

Cut costs, improve efficiency—automate your present water system with Simplex Orthoplex Supervisory Control

ORTHOPLEX SYSTEM can pay for itself during the first year of operation.

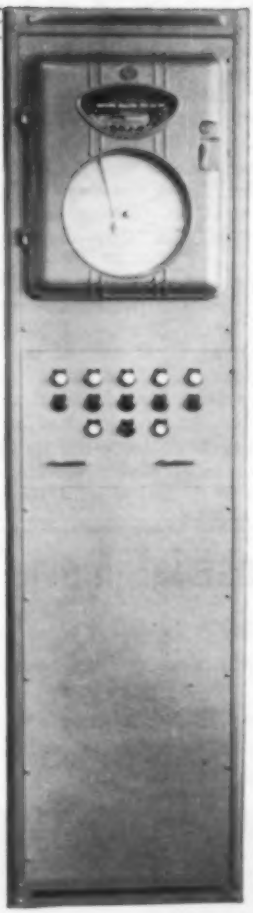
ORTHOPLEX assumes the responsibility for automatically controlling remote pumping stations, control valves, elevated tanks, reservoirs – FREES PERSONNEL FOR MORE IMPORTANT JOBS.

ORTHOPLEX can be installed to operate with most existing flow- and level-sensing devices without change or with the addition of new low-cost devices.

IMPROVED DESIGN reduces maintenance to the minimum by the elimination of all vacuum tubes, motorized timers and motorized sequence switches.

AS MANY AS 29 CHANNELS over a single pair of wires–private or telephone.

FOR COMPLETE INFORMATION, send us your requirements.



Central Control Station

*FLUIDICS is the Pfaudler Permutit program that integrates knowledge, equipment and experience in solving problems involving fluids.

SIMPLEX®
VALVE AND METER COMPANY
a division of PFAUDLER PERMUTIT INC.
Lancaster, Pennsylvania
Specialists in FLUIDICS... the science of fluid processes

SEE THE SIMPLEX ORTHOPLEX IN ACTION AT OUR BOOTH AT THE A. W. W. A. NATIONAL CONVENTION AT BAL HARBOUR, FLORIDA, MAY 15 — 20, 1960

PLASTIC SEWER MAIN INSTALLED

THE FIRST plastic sewer main in the United States has been installed in Needham, Mass. 300 feet of 8-in. main and 150 feet of 4-in. house connection pipe were used for the project. House service connections were made by saddle-type, solvent-welded plastic wyes with 4-in. branches to join the 8-in. main. All plastic pipe for the Needham sewerage project was furnished in 15-ft. lengths by the Evanite Plastic Co., Carrollton, Ohio, a division of the Evans Pipe Co., Uhrichsville, Ohio.

Commenting on the installation, E. A. Symonds, superintendent of sewers for Needham, said, "We have here an excellent test of the performance of a completely plastic sewer system from house drains to manholes. And having had an opportunity to evaluate the purported advantages of plastic sewers, with respect to control of infiltration and root intrusion, we are completely satisfied with the results."

● **LAYING 8-inch plastic sewer main for Needham, Mass., project. One man can handle the 15-foot lengths. Inset shows saddle-type wye used for house connection.**

Laying of the pipe presented no special problem even though there was considerable ground water present. Washed stone of ½ to ¾-in. size was used as a bed, and the stone was banked on each side of the pipe at least to the spring line. Backfilling to a depth of about one foot above the top of the pipe was done by hand; the remainder by machine.

Evanite plastic pipe can be cut anywhere and readily rejoined without further machining or working. It cuts easily, with a handsaw; can be drilled to make connections; and inspection holes can be cut in the main and closed by cementing a piece of pipe over the hole.

Since the initial installation of a plastic sanitary sewer the 8-inch Evanite has been used for a storm sewer with equal success.

(Advertisement)

Industrial Movie Program Wins Acclaim

Smith & Loveless Color Movie on Factory-Built Lift Stations Applauded by Engineers, Public Works and City Officials

The world's largest manufacturer of factory-built sewage lift stations has come up with "just about the world's easiest method" of showing their first industrial movie to prospective customers.

Smith & Loveless sales representatives use this convenient portable projector to show the firm's first industrial movie to prospective customers.

Sales representatives of Smith & Loveless, Lenexa, Kansas, use a special-built, continuous projector to show the firm's color-sound motion picture to engineers, builders, public works and city officials all over the United States and Canada. The projector, called a Cinesalesman, takes only seconds to set up and operate. It looks like a portable television set and is ideal for office calls on busy executives. Forty-five of the projectors are now in use to tell the Smith & Loveless story on factory-built sewage lift stations.

Movie Has Educational Value

The movie emphasizes the manufacture, operation, design features and installation of Smith & Loveless lift stations, used in municipal and suburban developments to raise sewage to a higher level or treatment facility. It includes a complete tour of the Smith & Loveless manufacturing plant near Kansas City.

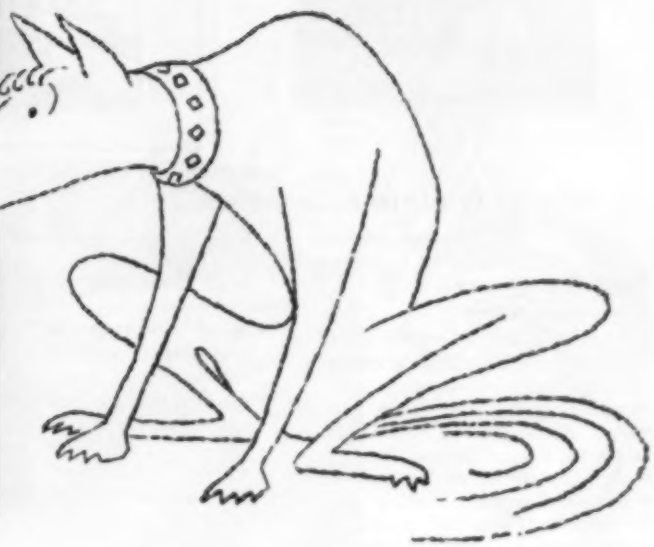
Program Wins National Award

The Smith & Loveless movie program was cited for "Exceptional Merit" in the national "Ideas for Home Builders" contest sponsored by the Producers' Council, Inc. and the National Association of Home Builders, Washington, D. C.

The continuous projector used by Smith & Loveless sales representatives.

Copies of the film are available for meetings and classroom use. Special showings can be arranged by contacting **Department 40, Smith & Loveless, Division—Union Tank Car Company, Lenexa, Kansas.**

2486



No dog, this seeing eye!

What started out as a favor to a friend (development of a Cleanable Sight Glass) has turned into one of our most gratifying enterprises. While not unusually profitable as a commercial venture, the good will implications are immense: over 500 sewage, water and industrial waste treatment plant operators throughout the world feel kindly toward Eimco-Process equipment because they can now *visually* control sludge withdrawal.

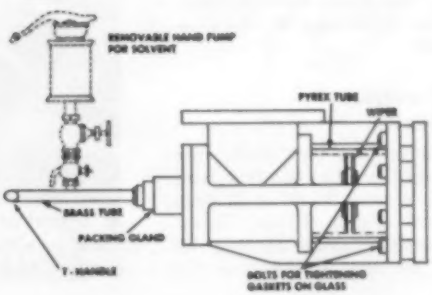
Think of it. Instead of guessing at that critical point where the heavy layer ends, they can see it. Instead of flying blind, they can witness the phenomenon of thin sludge being pulled through the heavy layer and, of course, take prompt remedial action (like shutting off the pump). And if grease in the sludge clouds the inside of the Pyrex, a little solvent injected through the hollow wiper rod and a few deft swipes of the wiper clear matters instantly.

Our obligation is clear: to make this inexpensive adjunct to efficient plant operation available to all operators as quickly as Eimco production schedules permit.

Your part is simple: if you have a 4″ or 6″ standard elbow in your sludge line, wire your Cleanable Sight Glass order and stand by with wrenches. Or, if you want to contemplate more facts and figures, send for Bulletin SM-1002. One way or the other, may we hear from you?

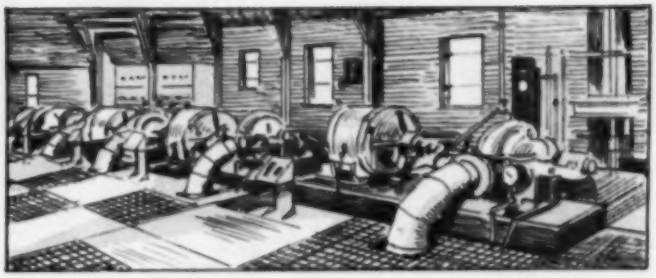
THE EIMCO CORPORATION

Process Engineers Division
420 Peninsular Avenue
San Mateo, California



B - 578

THE WATER WORKS DIGEST



Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Porous Membrane Demineralization

Engineers and scientists all over the world are searching for economical methods of turning sea or brackish water into fresh potable water. Among them is the manufacturing firm of Ionics, Inc., Cambridge, Mass., which has developed a porous membrane electric method of desalting brackish water to a useful level at a low operating cost. These membrane demineralizers are capable of removing a major portion of the dissolved cations (sodium, calcium and magnesium) and anions (chlorides, bicarbonates and sulfates), which contribute to hardness and alkalinity in natural waters, to provide potable water for household and industrial use. These membranes utilize the movement of salt by an electric current through the special membrane. One type of membrane permits positive ions to pass but bars negative ions. The other type allows negative ions to pass but bars the positive ions. When a number of these membranes are placed in the container as separators, arranged alternately, and a direct current voltage applied, alternate compartments are demineralized. About 30 plants are now in operation in small municipalities, ice plants, military posts, bottled water plants, isolated oil and running exploration camps, hospitals, utilities, and soft drink bottling plants.

"Porous Membrane Demineralization." *Water & Sewage Works*, February, 1960.

"Shock Treatment" Revives Wells

In rehabilitating two wells, one 862 feet and the other 882 feet deep, the Public Service Board of El Paso, Texas, used a new "Hydro-Sonic" redevelopment process recently introduced by the Halliburton Oil Well Cementing Co. The process is designed to remove certain types of flow restrictions in wells; namely scale, sand and silt, or materials that build up or migrate to cause a gradual reduction of flow. The process is performed by placing small explosive charges on a wire at calculated distances apart and detonating them in a special delayed time sequence by means of an electrical charge from the surface. The amount of explosive used in each charge is determined by the pipe size, thickness, grade and type, together with an estimate of pipe condition determined by a water analysis. Upon detonation, a shock-wave moves out from the charge and strikes the casing with a combination hammer-like blow and energy change. This helps to remove incrustation or scale build-up from the inside of the pipe and loosens or dislodges other material near the well bore. An air compressor and a 4-inch jet pipe were used to clean out the well. The treatment given both wells produced excellent increases in specific capacities. Charges for the treatment of the two wells amounted to a total of $1,832.50, a fraction of the cost approximating $140,000 for drilling two new wells.

"Shock Treatment Revives Wells." By James B. Kelly, Geologist, Public Service Board, El Paso, Texas; Clifford R. Jensen, Ass't Supt., In Charge of Maintenance of Wells, El Paso, Texas; and Ernst H. Gras, Staff Engineer, Halliburton Oil Well Cementing Co., El Paso, Texas. *Water Works Engineering*, February, 1960.

Ready To Serve Their Suburbs

In 1956 the City of Melbourne, Fla., was faced with a difficult decision when it was realized that their water utility would have to be completely rebuilt. After careful study it was decided to make the distribution system capable of serving neighboring towns and surrounding county area, and the plant easily expansible to serve the booming population growth now taking place in parts of Florida. The water treatment plant was built with a capacity of 6 mgd which can be doubled by the addition of one flocculator, one clarifier, and one filter. The intake structure, pumps

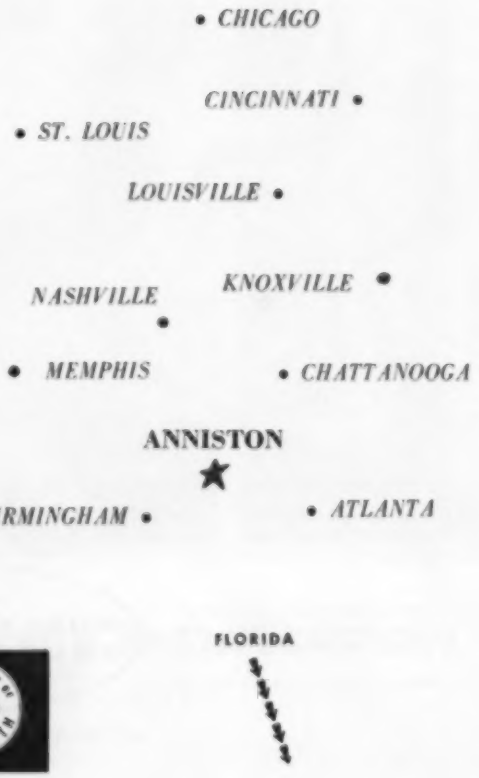
● **RESERVOIR is covered with aluminum arches to keep water cleaner and cooler. These were furnished by Kaiser and are of 0.32-inch alclad alloy 3004. Installed cost was $1.39 per square foot. This is the Stump Hill Reservoir, Pawtucket, R. I.**

We Invite AWWA *Delegates To*

STOP by ANNISTON

On your way to or from the AWWA convention May 15-20 in Bal Harbour, Florida (Miami Beach) stop at Anniston, Alabama, and visit with us. We cordially invite you to see our enlarged manufacturing facilities, break your trip for a few hours or a day and be our guests.

You'll find it time well spent to see first hand just how the high quality of M & H products is attained in our modern plant. Either stop by unannounced, or "if you let us know you're coming we will bake a cake!"



M&H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA
SUBSIDIARY OF WALWORTH

and plant hydraulic system have all been designed to handle 12 mgd. The plant takes water from Lake Washington. The raw water contains on the average about 200 ppm of color, mostly from tannic acid which is reduced to about 5 ppm by alum flocculation and the use of carbon in the Dorrco flocculator and clarifier. After sedimentation the water flows to two double filters equipped with Wheeler-type bottoms, Builders-Providence consoles and instruments, Palmer surface washers and Allis-Chalmers butterfly valves. Chlorine may be added to the clarifier, clear-wells or filters as desired. The system now serves 5,800 customers and this figure is growing at the rate of ten a day from Melbourne and the surrounding area comprising a total of 44 square miles. The entire program cost approximately $6,750,000 financed by a revenue bond issue.

"We're Ready to Serve Our Suburbs." By Tevis Huguely, City Manager, Melbourne, Fla. The *American City*, February, 1960.

Diatomite Filtration

When it became evident for the Village of Palmyra, N.Y. that a new plant must be built to meet the increasing per capita water demand, a diatomite filter installation was decided upon. The plant is housed in an attractive one-story building measuring 36 by 28 feet. Design capacity is 500,000 gpd, with provision for easy expansion to 750,000 gpd total. The main filter installation consists of two 200-sq.ft. Sparkler Model SCJ diatomite filters, with circular perforated stainless steel leaves covered with Orlon cloth. Design capacity is 1 gal/sq.ft./min. Both body feed and precoat are supplied from a 300-gallon slurry tank which is filled daily. At the start of each cycle, the filters are precoated with 0.15 lb./sq.ft. of Johns Manville Hyflo Super Cel, or a total of 30 lbs. per filter. The precoat is applied by means of an eductor as a slurry containing about 0.4 lb. (about 5 percent) of diatomite per gallon. Following the precoat opration the filters are run to waste for three or four minutes, or until examination of an effluent sample shows no sign of filter aid particles. During the filter run a body feed of the Hyflo Super Cel is fed as a 5 percent slurry by the diaphragm pump at the normal rate of about 4 mg/L of filter aid for each mg/L of raw water turbidity. Each filter run continues until the pressure differential through the filter has reached 10 to 15 psi, which is generally for a period of two to four days. The filters are provided with built-in jet sprays for backwashing and this operation can be completed in about 15 minutes using from 500 to 1,000 gallons of treated water. This compact, efficient plant has been in operation for more than three years and has provided for all the increased water demand at low initial and operating costs.

"Diatomite Filtration Works For Palmyra." By William E. German. Water Treatment Plant Operator. PUBLIC WORKS, March, 1960.

Filter Evaluation

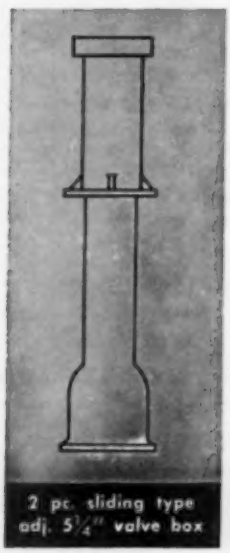
A filter evaluation program, in which small experimental filters are utilized, has been conducted at Hanford, Wash., since 1950. The most satisfactory equipment used for this study is a small 5-gpm complete filter plant equipped so that during chemical treatment, the flocculation time and speed, settling time, and filtration rate can be varied over a wide range. Filters made of sand alone, anthracite alone, and sand and anthracite together, of various particle sizes and depths, were evaluated. As an aid to judging the

BUFFALO PIPE & FOUNDRY

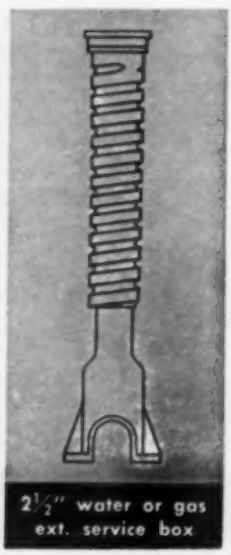
BUFFALO MUNICIPAL CASTINGS

are available in every size and style!

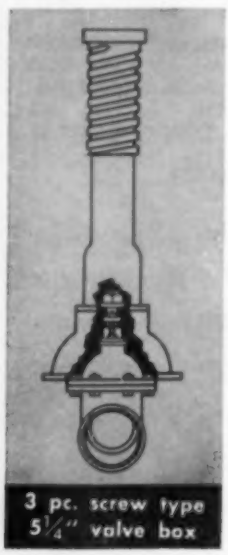
No matter what size, shape or style municipal casting you may desire — you're practically sure to find a "Buffalo" casting to serve your needs. Or, where desired, castings may be made to your own specifications. Whether you need valve, service or roadway boxes, meter boxes, manhole rings and covers or other municipal castings, you'll find all "Buffalo" castings designed for service and dependability.



2 pc. sliding type adj. 5¼" valve box



2½" water or gas ext. service box



3 pc. screw type 5¼" valve box

Prompt quotations given on all your standard or special gray iron or non-ferrous castings.

Write or wire Dept. J for Bulletin M11.

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BUFFALO PIPE & FOUNDRY CORP.

BOX 55 – STATION B DE 6764 BUFFALO 7, N.Y.

starting . . .

a century of tax-saving service

permanent rust-resistant

CAST IRON PIPE

Today 68 American cities are still using cast iron water mains installed a century or more ago. No nonmetallic substitute has ever matched this record for longevity and long run economy.

Long life — lowest long run cost — are two of many reasons why Cast Iron Pipe is the best investment your community can make for new installations or extensions of water mains or sewer lines.

Lowest Maintenance Cost

Maintenance cost of Cast Iron Pipe is far below that of any other pipe material which has been in use long enough for the recording of conclusive data. This is due to its effective resistance to corrosion, its wide margins of safety in strength to withstand impact, beam and crushing stresses.

Finally, there's the factor of —

Re-use or Salvage Value

When water mains must be abandoned, re-routed or replaced by larger sizes, Cast Iron Pipe can be re-used or salvaged at a further substantial savings.

This advertisement is published in the interests of the Cast Iron Pressure Pipe Industry by .....

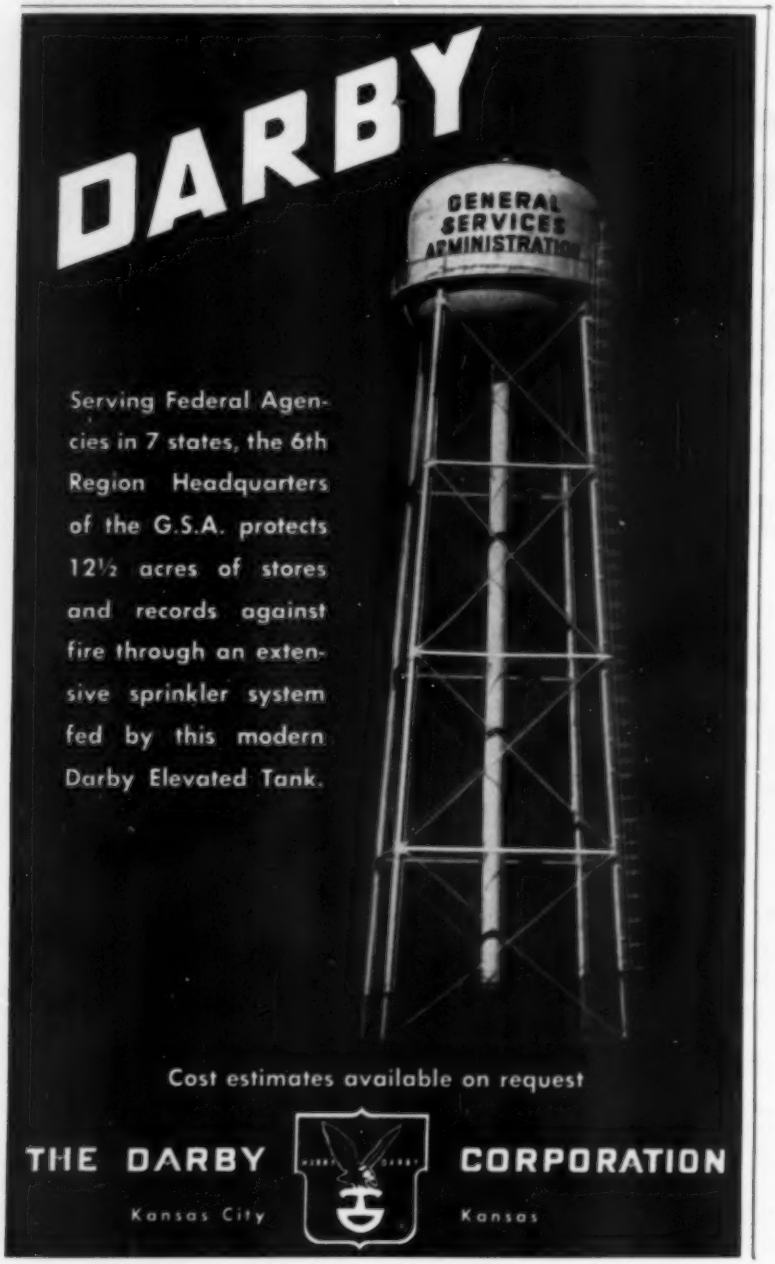
WOODWARD IRON COMPANY

Since 1882

WOODWARD, ALABAMA

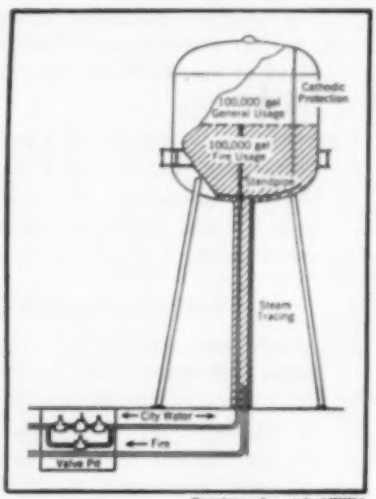
filter performance, criteria were prepared which specify that a satisfactory filter must produce filtered water containing less than 0.01 ppm turbidity and that the filter run must be at least 6 hr. for all raw-water conditions encountered, at a filtration rate of 6 gpm/sq.ft. and with a settling time of 1 hr. As a result of these studies a number of conclusions have been reached: 1) Filters made either of sand or of anthracite alone do not meet the proposed criteria. 2) Filters made of sand and anthracite together did meet the criteria. 3) The best combination of particle sizes and depths of these two materials was 8 in. of 30-40 mesh sand (U.S. sieve) and 22 in. of 6-18 mesh anthracite. Performance of all filters varied greatly with chemical treatment and raw-water changes. Long filter runs depend upon distribution of coagulated matter uniformly throughout the depth of the filter. The experimental results presented in this article were obtained from studies of Columbia River water.

"Test Program for Filter Evaluation at Hanford." By Walter R. Conley, Engr., and Raymond W. Pitman, Specialist, General Electric Co., *Journal A.W.W.A.*, February, 1960.


DARBY
GENERAL SERVICES ADMINISTRATION
Serving Federal Agencies in 7 states, the 6th Region Headquarters of the G.S.A. protects 12½ acres of stores and records against fire through an extensive sprinkler system fed by this modern Darby Elevated Tank.
Cost estimates available on request
THE DARBY CORPORATION
Kansas City
Kansas

Industrial Use At Kingston

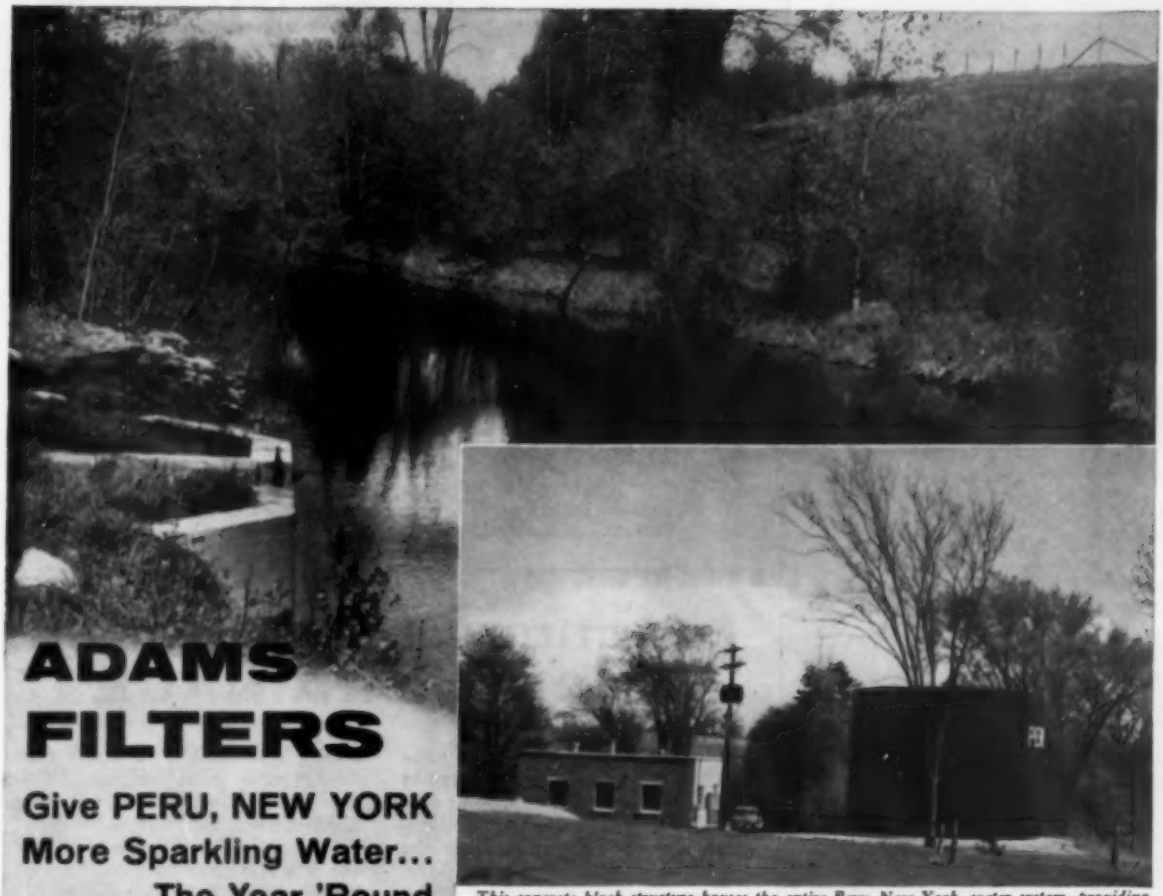
The International Business Machines Co. plant located at Kingston, N. Y., obtains its water supply from the City of Kingston. The city water lines were tapped with a single 12-in. feeder, which is the only water source for the plant; the plant is the largest single user on the city system using approximately 5 mgd. The major water requirements of the plant are: 1) Sanitary use, cafeteria use, drinking water, vending machines, and other domestic uses. 2) Industrial use, which is the largest use, in the plating area, the etched-card area, the paint shop, and the heat treat area. 3) Boiler makeup water, cooling tower makeup, and bearing cooling. 4) Waste treatment, including all sanitation and industrial wastes. 5) Fire protection use, which, fortunately, is small. 6) Miscellaneous uses, such as roof flooding, refrigerator condenser cooling, and lawn sprinkling. Under normal conditions, the water feeds into the 200,000-gal. elevated



Courtesy Journal AWWA

● **WATER tank for the Kingston plant. Capacity is 200,000 gals; half is reserved for fire protection. Tank is heated and has cathodic protection.**

storage tank which floats on the system. Half of the storage capacity is reserved for fire fighting and cannot be drawn through the domestic loop. This piping arrangement insures the maintenance of the fire reserve at all times. A stringent water conservation program has been instituted throughout the plant by recirculation of water in the 6,000-ton air conditioning system, by reuse in the boiler house, by discontinuance of roof flooding during periods of water shortage and by conductivity cell control in the plat-



ADAMS FILTERS

Give PERU, NEW YORK More Sparkling Water... The Year 'Round

This concrete block structure houses the entire Peru, New York, water system, providing approximately 150,000 gpd, at an average daily flow of 225 gpm. The Little Ausable River intake weir is shown above.

Mr. Joseph Morrow, Water Department Superintendent, Town of Peru, New York, is quite pleased with the simplified operation of the three Adams #169 filters which handle the town's entire water supply. Mr. Morrell Vrooman, Jr., of Gloversville, N. Y. was the consulting engineer.

The Town of Peru, New York, located in northeast New York State, now boasts a year 'round water supply of unequalled clarity and brilliance. Since its new filter plant was completed in the Spring of 1959, the town has experienced a marked improvement in the quality of its water supply. Residents today are quite proud of their "clear mountain stream" water.

In the past, Peru normally obtained its water from a mountain reservoir which provided settling. During dry spells they pumped it from the Little Ausable River. Since screening and chlorination were the only steps taken to make it suitable for human consumption, the water was affected by storms, run-offs and in dry weather by the change of source. The decision was made to install a filtration plant of three Adams 169 diatomite filters.

The original concept of the new filter plant was to treat only water from the Little Ausable River. However, preliminary tests of the new plant were conducted using reservoir water. After filtration the clarity, odor and color of the water were so greatly improved that plans were made to filter all of the town's supply.

The system, using Adams filters, is conveniently housed in a simple block concrete structure. Because of its compact area, no elaborate foundations or other elaborate concrete work was required. The extended filter cycle has minimized maintenance and labor costs. The Adams diatomaceous earth filter design offers the ideal solution to small municipality filter problems.

Why not investigate how the Adams line might improve your or your client's water supply. Write today.

R. P. ADAMS CO., INC.
228 East Park Drive Buffalo 17, N. Y.

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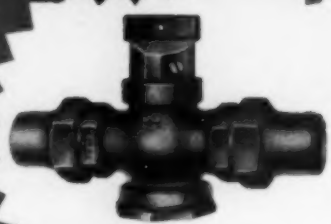
water service
products
IT PAYS
TO BUY
HAYS

CURB STOPS
one of a
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GENERAL PRODUCTS DIVISION
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ERIE, PA.

ing and etched-card areas. New methods and techniques are constantly being sought and put into practice to improve efficiency in the use of water.

"Industrial Use and Conservation at Kingston." By William Helmrich. International Business Machines Corp., Kingston, N.Y. *Journal A.W.W.A.*, February, 1960.

Other Articles

"Continuous-Flow **Water Pasteurizer** for Small Supplies." The pasteurization unit described in this report has performed satisfactorily in destroying coliform organisms at approximately $1.00 per 1,000 gal. By Melvin Goldstein, Ass't. San. Engr.; L. J. McCabe Jr., San. Engr.; and Richard L. Woodward, Chief Eng. Section; all of the Water Supply and Pollution Research Branch, Robert A. Taft Eng. Center, USPHS, Cincinnati, Ohio. Journal A.W.W.A., February, 1960.

Evaluation of **Membrane Filter** Technique for Appraising Ohio River Water Quality." The findings of this study resulted in the adoption by the Ohio River Valley Water Sanitation Commission (ORSANCO), in 1958, of the membrane filter technique as an optional alternative to the MPN procedure for bacteriologic analysis of river water. By Harold W. Streeter, Staff Consultant and David A. Robertson, Jr., San. Engr.-Hydrologist, both of ORSANCO. Journal A.W.W.A., February, 1960.

"Water **Supply Tunnel.**" Sydney, N.S.W., Australia meets demands by a new 10-mile tunnel. By J. Grindrod, New Milton, Hants, England. Water & Sewage Works, February, 1960.

"Pipe Jointing." This is the fourth installment in a continuing series on construction supervision. A Staff Report. Water & Sewage Works, February, 1960.

Practices in Financing STORM DRAINAGE

THIS IS A continuation of an article on this subject which began in our March issue. Engineers and officials from all over the United States have provided information on the measure of benefits from storm drainage and how to determine such benefits; the old problem as to relative benefits to and assessments on hill and valley property; and local regulations relating to the discharge of storm water to streets. Replies were summarized in the March issue; in this issue, selected comments are continued to illustrate the approach by engineers to the storm drainage problem.

Traverse City, Mich. — Storm sewers are financed by assessment districts with the city at large absorbing from ¼ to 1/3 of the cost. The assessment is pro-rated to the individual properties on the basis of the respective areas. Sanitary sewers are assessed on a connection basis. No differential is made in assessing storm sewers between properties on a hill and properties in a valley. We are fortunately situated here with respect to storm sewer outlets and our drainage areas can be relatively small. We have found it possible to assess one whole district, including the outlet, on an equal basis to the benefited property.

We do not ordinarily require private properties to connect to storm sewers except for condenser water or air conditioning equipment of a commercial nature. In most cases we require such effluent to be carried to a dry well if storm sewers are not available.

We have a general sewer plan for the city and have been working our storm sewers in conformity with it for a good many years.—J. A. Rowley, City Engineer.

St. Louis Park, Minn.—Storm sewers are assessed on a front foot basis. We determine the area drained and those properties are assessed on their front footage. Sanitary sewer trunks are assessed on a unit basis; and laterals are on a front foot basis. The difference between storm and sanitary sewer assessment is that the storm sewer may not be in the street abutting the property, but if the area is drained it is assessed for the sewer. The sanitary sewer is in the street abutting each parcel assessed.—R. O. Folland, Director of Public Works.

Bloomington, Minn.—The measure of benefits for storm drainage is determined on a square foot basis. There are no sanitary sewers in Bloomington. For storm drainage, benefits are the same for property on a hill as for property in a valley, since the basis is area. Property owners may discharge storm water to the street. A trunk main storm sewer for the whole village is being planned.—Frank V. Laska, Village Engineer.

Greenville, Miss.—Storm drainage is placed generally at the time the street is paved and curbed. The cost is included in the paving cost, and the street assessed on the front foot basis. On storm drainage other than on streets, the storm sewer cost is assessed by taking total drainage area benefited, and assessing prorata shares in accordance with lot or parcel area.—John H. Teunisson, Jr., City Engineer.

Billings, Mont.—For storm drainage, any property which will drain into the storm sewer is assessed on a sq. ft. basis for the entire district. —Sam Ward, City Engr.

Falls City, Nebr.—Storm sewers are paid for from the regular tax levy, and are not assessed. Therefore we do not have to determine benefits to any particular properties. In general, private properties are not required to connect to storm sewers.

The City has no well-defined policy in regard to sanitary sewer benefits. The last sanitary sewer project was paid for out of general funds, and was not assessed.—D. J. Prosser, City Engineer.

Sparks, Nev.—Storm drainage is usually financed out of General Fund. Subdividers in tract developments are required to install storm drains at their own expense. Drains must meet City standards and requirements. In those cases where drains have been provided by assessment, such assessment has been on a front foot basis for all properties located on streets benefiting.

For any unusual storm drainage problem other than normal run off from driveways, roofs, etc., property owners are required to connect to drain.—R. W. Rank, City Mgr.

Newark, N. J.—The cost of storm drainage systems is assessable against the properties benefited within the drainage area. Extensive sanitary sewerage systems are also assessed against properties benefiting plus direct assessment for construction of lateral sewers serving contiguous premises. All properties within a given drainage area whether upland or lowland are considered equal in benefits and assessed on the basis of area drained.

Where separate systems exist, large structures are required to connect leaders directly to storm sewers. One to three-family dwellings are permitted to connect leaders to the sanitary system in the building provided there is a combined sewer in the street of sufficient size to warrant it. Where only sanitary sewers are available, storm water is discharged into the street area.—

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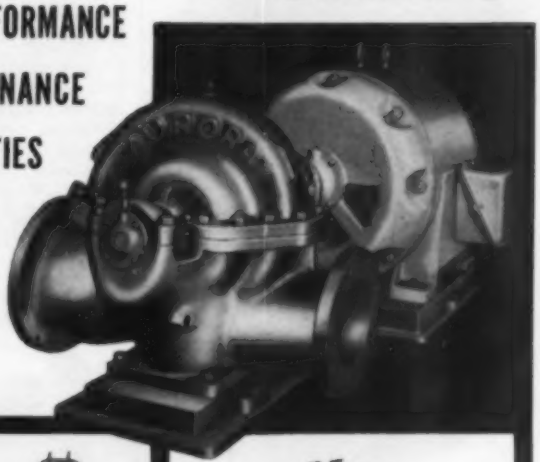
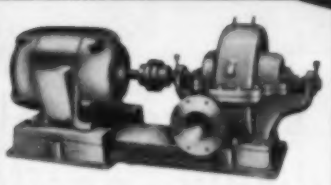
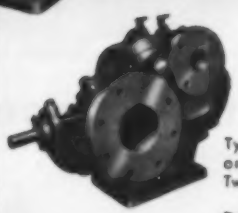


Type OJ Horizontally Split Single Stage Double Suction. Bulletin 105-B.



Type AJ Horizontally Split Two Stage Opposed Suction. Bulletin 106-B.



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George W. Andress, Dir. Dept. of Public Works.

Massena, N. Y.—Storm sewers are financed by "Storm account." Property owners are not assessed for storm drainage. We do not have any set method of determining benefits for storm or sanitary sewers. Our sewer program is set up on a yearly basis according to money available and the needs of various sections of the village. Private properties are not required to connect to a storm sewer. Roof drains are allowed to be drained into the street. A Village-wide storm sewer system is not being planned. All design of storm sewer systems is done by village personnel.—R. D. Cross, Supt. of Public Works.

Yonkers, N. Y.—Storm sewers are financed by both assessment of the benefited area and by City-at-Large assessment. Cost of all storm sewers 24-inches in diameter and over are City-at-Large assessments. Assessments are split into two categories—Direct Benefit and Indirect Benefit. Direct Benefit is usually charged to those whose property has frontage along the sewer. Indirect Benefit is charged to all others in the entire benefited area. Indirect Benefit Charges usually vary between 1 and 2½ cents per square foot while Direct Benefit Charges usually vary between 15 and 17 cents per square foot.

Direct costs as defined above may be levied against property only once. When storm sewer systems are built in sections, direct costs are assessed on the basis of the cost of the minimum size of pipe which would serve the section being constructed. The additional cost of larger diameter pipe is then attributed to the uphill drainage area and assessed against this indirect area. Therefore property on a hill might receive several indirect costs and one direct cost, making the cost to an "uphill" property owner greater. This is substantiated by the fact that a longer length of sewer is necessary to serve the uphill area.

If a storm sewer is available, private properties must conect. If no storm sewer is available property owners may discharge storm water into the gutter.—Earle Griffin, City Engineer.

Dickinson, North Dakota—I have been here for five years and have not as yet designed a storm sewer. The one storm sewer job that was done during this time was by a consulting engineer. The methods of spreading the assessments as closely as can be determined is as follows: Storm sewers—20% general assessment (City wide); remainder assessed on an area basis and if the lots are about equal in size they were assessed the same. Sanitary sewers—Trunk lines are 20% general assessment; all other lines are on a lineal ft. basis with few exceptions.

We are in the process of requiring all commercial buildings to hook to the storm sewers.—Don Cuskelly, City Engr.

Minot, N. D.—Storm sewers are paid for by special assessment taxes. Benefits are determined by a Special Assessment Commission, usually on area basis. Sanitary sewer benefits are usually based on units or parcels of land. The storm sewer benefit on a hill is the same as that in a valley. Private properties in the central business district are required to connect to storm sewers.—Peter B. Metz, City Engr.

Rittman, Ohio—Storm sewers are financed either by front foot assessment or by benefit, depending on size of pipe required or area involved. Where larger areas are involved we decide on a primary and secondary area.

Where the property involved would require only a smaller size but a larger one is installed because

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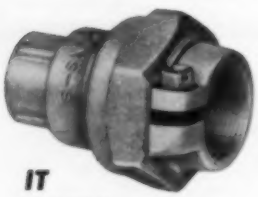

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of other drainage, the difference might be paid by the Village.

If only a small area is involved such as one or two streets and the sewer is put in at the same time as paving the cost is assessed on a front foot basis.—Stanley M. Levers, Village Engineer.

Tulsa, Okla.—Storm sewer construction is financed in our City by two methods: 1) From bond funds, which are voted by the electorate of the city; and 2) by assessment under paving districts.

Under our long time policy, but not by law, we attempt, generally, to spend money for storm sewers 36-in. dia. or larger from Bond Issue Funds; sewers of lesser diameter are included in assessment districts for paving and are paid for by the property owner. Where costs are by assessment, these are determined by the relation of the area of each property to the area of the benefited district as provided under State Statutes; that is, all costs of all storm sewer construction within the bounds of the street improvement district are prorated amongst the properties on the basis of square foot costs. In other words the cost per square foot of storm sewer drainage is the same throughout.

This is the same method fixed by the State for determining the costs for sanitary sewers.

Under this law the benefit derived for storm sewer is the same for property on the hill as in the valley, presumably, on the idea that it rains equally on each location and the same amount of runoff develops from each square foot of property involved.—Wm. R. Wooten, City Engineer.

Dallas, Ore.—All storm sewers designed in paving projects to be assessed to abutting properties are paid for out of funds in the Street Department. These are usually 10" or 12" to 18". Larger sewers are paid by General Obligation bonds. An extensive storm sewer system has been designed for the city but has been held in abeyance because of the necessity to increase the water supply for the community. When this sewer will be constructed and how it will be paid for is still being studied.

Sanitary sewers, up until 1958, when three new Sewer Districts were constructed, was on a unit basis. Each piece of property served by a wye was charged its proportionate share of the total cost of providing the sewer.

In 1958, because of large unimproved pieces of property and a lengthy sewer we charged $100 per

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Below, A-2-13 Clark Meter Box Cover with screw lock. Height 4", lid opening 13".

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Above, AA-3-12 Clark Meter Box Cover with 13" Wonder Lock Lid, for use with 15" (illustrated), 18" and 20" box body.

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wye plus 0.011¢ per sq. ft. using 10,000 s.f. for each wye, before applying the s.f. charge.—M. David Warren, Street Commissioner and Supt. of Streets and Sewers.

Ashtabula, Ohio—Both storm and sanitary sewers are financed by a 2 mill permanent levy. This separate fund is partially replenished from special assessment on a front foot basis. Storm drains are designed on a drainage area basis but assessed on a purely local drainage basis. Since all our trunk sanitary sewers have previously been constructed the total cost of extensions is borne by the abutting property on a front foot basis except on corner lots where a sewer has previously been paid for. In such cases the frontage of the lot (not to exceed 150') is exempt.—Ronald Logan, Supt. Dept. Public Works.

Hamilton, Ohio—Storm sewers are financed by general bond issues or by assessments. If by assessment the benefits are the same for each lot the sewer serves.—O. Elmore Martin, City Engineer.

Worthington, Ohio—We assess for both storm and sanitary sewers on an area or district basis and use benefits received to determine costs to each parcel.—James E. Johnson, City Manager.

Lebanon, Ore.—All trunk sewers that carry drainage gathered from laterals and all drainage constructed in street intersections are financed as a general obligation of the City. As nearly as practical an area set up as a drainage district which is served either directly or indirectly by the drainage facilities, pays for all of them, by assessments against the property according to the area of each and on a square foot basis regardless of the topography.

Sanitary sewers are financed by assessments against the benefited property according to the frontage on the project in laterals, the trunk lines being financed the same as storm sewer trunk lines. Street gutters are planned to drain the greater part of the adjoining property but where this is impractical the property owner may connect his storm sewer to the District facility.—G. E. Whitcomb, City Surveyor.

Portland, Ore.—Storm sewers are paid for by equal assessments to all property owners in the drainage area. Only those property owners receiving direct service are assessed on sanitary sewers. The benefit for a storm sewer is the same for property on a hill as for property in a valley. Private properties are not normally required to connect to storm sewers.—Gordon L. Burt, City Engineer.

Kingsport, Tenn.—No assessment made against abutting property owners for storm sewers. These sewers may be financed by Capital Improvement funds, General Obligation Bonds or other revenue. When storm drainage is part of street costs, the City share of the State gasoline tax may be used.

Sanitary sewers within an improvement district are financed ¾ by abutting property owners, ¼ by City General Fund. Trunk line sewers usually are financed by General Obligation Bonds.

Down spouts, etc., may discharge into gutters. Business houses, where practicable, discharge storm water, cooling water, etc., into the storm sewer or a catch basin.—M. L. West, Director of Public Works.

Mt. Vernon, Wash.—Storm sewers are financed mainly as by-products of street paving improvements, becoming a necessary but minor portion of the major item of street paving. These are, of course, lateral sizes and in some cases the curbs transmit the drainage to sump points not requiring any actual storm sewer laterals until a later adjacent request for street paving. To date we have not paved any street in our newer

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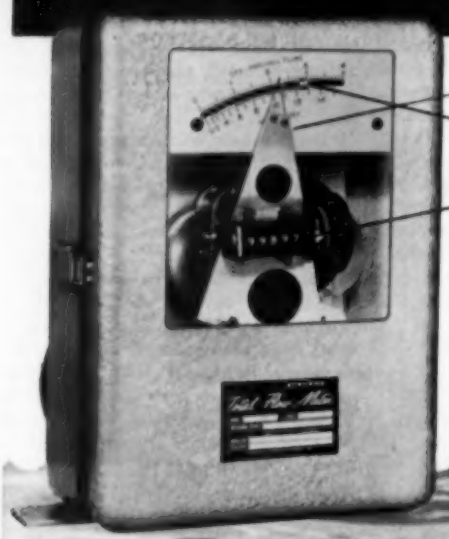

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Mechanically operated meter provides essential data in measurement of sewage, industrial wastes, irrigation water or other liquids flowing in open channels. Standard meter gives direct flow reading in cu. ft./sec. and totalizes volume in cu. ft. Readings are easily converted to other units of measurement.

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residential areas unless we have installed the necessary sanitary and storm sewer systems underground in accord with our master plan.

The problem is relatively simple in the remote parts of a drainage area where laterals are 8" minimum diameter but will become more difficult as we approach the area where larger trunk sizes are required.

We have tried to project a storm trunk sewer L.I.D. for an entire area and very nearly succeeded. The local assessment area of the equivalent cost of a lateral storm sewer upon the abutting property owners was the disturbing element. Therefore, we are convinced that the "Zone & Termini" method will not satisfy the reasonable desires of the property owners and benefits must be assessed upon a square-foot benefit area method. Probably two benefit areas are necessary—one for lateral sewers and one for trunk storm sewers—except that if the entire area could be totally sewered at one time, then a single square-foot benefit cost would be the fairest application of the law and the cost.

At present the City finds this problem one of its most difficult and often finds itself participating to make the requested L.I.D.'s for street paving improvements possible.

Our biggest concern is whether we can continue to build these laterals and still come back upon the properties so benefited for an area charge for the trunk sewer costs which are in excess of the intended local assessment charges.

Frankly, storm sewer installations would not and have not been too difficult when we can approach the overall storm sewer layout by adding portions of the system as street improvements demanded their construction. Lower end drainage by the usage of the original drainage ditches has been fairly satisfactory.

Sanitary sewers are paid for on an area square-foot basis as stated above. Sanitary sewers are definitely a personal benefit. Sanitary sewers are installed to front each property; hence they justify a front-footage charge by the L.I.D. method. However the sewer service user utility charge is the most satisfactory approach. The people, in the majority of cases, seem to prefer a hidden type of cost of the installment type —such as a $3.00/month user charge to finance municipal bonds. This approach depends however upon users which means that a period of growth with septic tanks in the interim is almost vital.

Benefits are the same for any square foot within the area drained by the trunk storm sewer system.

Only the commercial or highly developed area, i.e.—a hospital with tremendous roof areas, parking areas, etc., not residences, are required to drain through the curb to the gutter line.—Gwynne D. Le Gro, City Engineer.

Pullman, Wash.—Storm drains are financed by Local Improvement District bonds. Storm drain districts are defined by zone and termini and in some cases by drainage areas. Cost is proportioned on a sq. ft basis for lateral and trunk. Sanitary sewers pay on a sq. ft. basis for a district defined by platting with tributary areas for trunks.—Carl Arness, City Engr.

Tacoma, Wash.—Storm trunks are financed by General Obligation Bonds, and storm laterals are financed by Local Improvement District assessments. Since storm laterals are generally an integral part of permanent street construction, the measure of benefits is considered to be the same as the benefits derived from the street improvement. The method of assessing storm drains as compared with sanitary sewers differs insofar as property may be assessed twice for storm

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In small amounts, Triangle Brand Copper Sulfate controls algae growth and kills some of the more troublesome aquatic weeds. They disintegrate where they are, which prevents downstream infestation or clogged waterways.

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Two informational booklets, "The Use of Copper Sulfate in the Control of Microscopic Organisms," and "Copper Sulfate for Root and Fungus Control in Sanitary Sewers and Storm Drains," available on request.

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drains if they are required when the street fronting the block is paved and when the side street on the end of the block is paved. Sanitary sewers are normally assessed in accordance with the frontage of the property in one direction only, making the assessment on similar sized lots equal.

The benefits for storm drainage are considered equal for property on a hill or in a valley.

Where their drainage or cooling water is of an amount that would create a hazard in the street, private property would be required to connect to a storm drain. Where the amount of drainage would not create a hazard, private property may discharge drainage through the curb to paved streets only.

We have presently completed about 50% of the design and 25% of the construction of a $2,775,000 bond issue authorized by the voters in March, 1958.

We are planning an extensive program to separate completely the storm and sanitary sewer system within the City at an estimated cost of approximately $12,000,000. This program will be financed by revenue bonds to be retired by a sewer service charge of $2.00 per month per residence. The first year's program will amount to approximately 23 miles of sewers varying in size from 8" to 60" in diameter and estimated to cost approximately $1,400,000.00.—C. A. Knecht, Office of City Engineer.

Spokane, Wash.—Only one storm sewer has been installed in the City. All other sewer systems are combined storm and sanitary, except for one sanitary pumping district and a newly annexed area. Storm sewers for these areas are now being designed, serving approximately 800 acres. Costs are not yet available, but probably will run $200,000. Method of assessment will be determined soon. All contributing area to the system will be assessed on the same basis for the same land use. Any difference between assessments for a storm or a sanitary sewer has not yet been resolved. We should have some answers on this for next year's questionnaire.

Private residential property does not ordinarily connect storm drainage to storm or combined sewers as roof drainage is disposed of on lawns. Commercial properties use storm sewer connections or combined sewer connections if capacity is available. Some use on-site dry wells. Drainage to street gutters is unsatisfactory. — A. M. Eschbach, City Engineer.

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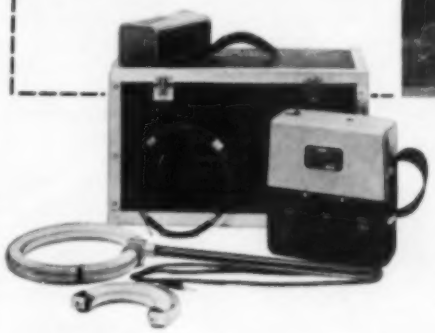

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Portable, "damp-climate," pulse type holiday detector for coated surfaces.

To obtain maximum protection and hold maintenance costs to a minimum, inspect protective coating with a Tinker & Rasor Holiday Detector and make repairs before backfilling. Minutes spent inspecting the pipe with a Tinker & Rasor Holiday Detector while the ditch is open can save days making repairs later on. Clearly, if protective coating is desirable, the best possible protective coating is *most* desirable.

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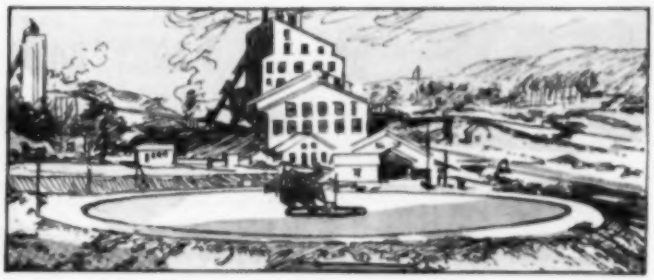


Prepared by **CLAYTON H. BILLINGS,** *Associate Editor*

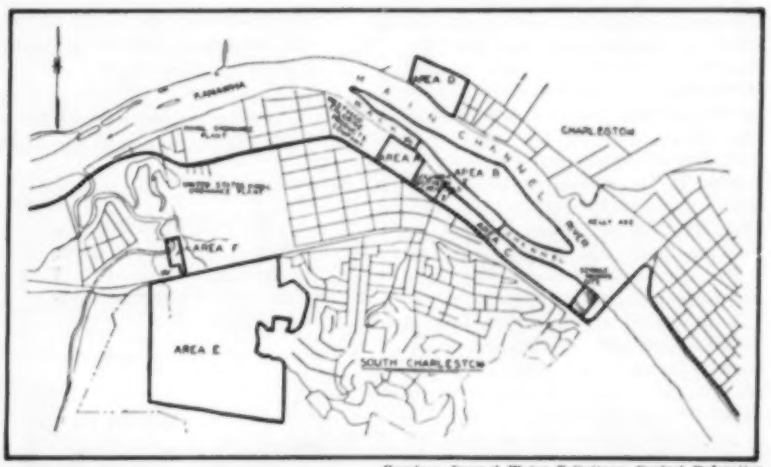
Municipal and Chemical Industry Co-op Plant

The residues from the manufacture of about 400 chemicals are responsible for the waste disposal problem of the Union Carbide Chemicals Co. plant at South Charleston, W. Va. Required by the regulatory agencies to cease pollution of the Kanawha River, the firm and the City of South Charleston investigated the problem of providing treatment for the wastes and the possibility of establishing joint domestic and industrial waste treatment facilities. The investigation at Union Carbide involved segregation and collection of wastes and determination of the flow and BOD load. Carbide's installations are physically divided into five separate areas by the River and intervening plants or residential areas. This made it necessary to construct weirs, manholes and collection sewers, which eventually made it possible to collect 37 percent of the total pollutional flow and 61 percent of the total BOD load. A back channel survey was made since it was impractical to measure the load from each contributing unit. It was expected that determining the BOD upstream and downstream of the waste discharge points would provide a measure of the load contributed. It was found, however, that computed loads were always lower than those found in the river. Investigation showed that probably the reason for this is that synthetic organic chemicals are not attacked biochemically in the same manner as domestic sewage, requiring a different technique for BOD tests. A large pilot plant was constructed to evaluate treatment by trickling filters and activated sludge. The latter process was selected primarily for economic reasons, considering both construction and operation costs. Union carbide agreed to join the City of South Charleston in building a joint treatment plant, based on the following conditions: 1) The City would own the plant; 2) Union Carbide would furnish pilot plant data to be used as a design basis and would design the plant; 3)the City would hire a subsidiary of Union Carbide, expressly organized for the purpose, to operate the treatment works; and 4) costs would be shared by the Company and the City of South Charleston.

"Joint Industry and City Waste Treatment: Combined Approach as Viewed by Industry." By George P. Schrader, Project Engineer, Union Carbide Chemicals Co. *Journal Water Pollution Control Federation*, February, 1960.

Design of City-Industry Co-op Plant

Conferences with regulatory agencies concluded that the initial treatment facilities for the Union Carbide Chemicals Co. waste flow and South Charleston, W. Va. domestic sewage should accomplish an overall BOD reduction of 42 percent. This is to be done by primary treatment plus secondary treatment of one-third the total waste flow. The Union Carbide waste flow averages 7,000 gpm and 130,000 lb. 10-day BOD. That of the City, projected to a design population of 42,500 in 1985 is expected to be 4,050 gpm. The pilot plant studies on the chemical plant waste indicated the major problems would be controlling a pH that varied between one and 13 and primary sludge handling. Solution of the latter problem was deferred until after the treatment plant is built, with space reserved for sludge thickeners, vacuum filters and incinerators. Since the industrial waste sludge would be biostatic, it was decided to use separate primary clarifiers in order to avoid mixing of domestic and industrial waste sludges. The facilities for pH correction will involve using equipment for continuous adjustment. The design solution was worked out using an analog computer and consisted of three-stage blending and correc-



Courtesy Journal Water Pollutionn Control Federation

● **MAP of South Charleston, W. Va., showing the Union Carbide Chemicals Company problem of centralizing treatment. Areas A, B, C, D, E produce effluents.**

At Cincinnati's new Mill Creek sewage works,

Jeffrey Flocculators and Sludge Collectors

Only a third of the Jeffrey flocculation-settling system is visible in this construction photograph.

Taken two years ago, this airview shows the wide extent of this 122 mgd treatment plant. Consulting Engineers, Haven & Emerson of Cleveland and New York.

Flocculation and settling are handled here in the same tanks, training baffles being used to separate the two functions. Eight of these combination tanks provide detention in the flocculation zone for 30 minutes and in the settling zone for 90 minutes, or a total of 120 minutes of settling time without flocculation, based on a daily flow of 122 mgd.

Jeffrey sludge collectors are in each channel of the flocculation tanks, as well as in each channel of the settling tanks.

Behind the plans and equipment offered by the Jeffrey Sanitary Engineering Department are 65 years' experience in materials handling. This qualifies Jeffrey to offer complete technical information and apparatus on plant layout and machinery. The Jeffrey Manufacturing Company, 947 North Fourth Street, Columbus 16, Ohio.

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2. BERMICO is exceptionally root resistant. There has never been a single case reported, of a Bermico sewer line, properly installed, being penetrated by roots!

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For further information about Bermico and communities that have included bituminized fibre pipe in their codes . . . write Brown Company, Dept. 140, 150 Causeway Street, Boston 14, Massachusetts.

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tion with addition of sulfuric acid and 50 percent caustic. The pH problem necessitated using special alloys and coatings in the treatment units. The combined plant will consist of comminutors, grit separators, primary clarifiers and a chlorine contact basin for the domestic sewage. The industrial waste flow will be directed through grit separators and primary clarifiers. After leaving the primary clarifiers, the flow will be split with one-third passing through blenders for pH correction and thence joining one-third of the primary treated domestic sewage for activated sludge treatment. The complete-mixing type design was selected. The total project cost is expected to be about $8.6 million of which Union Carbide's share will be about $6.3 million.

"Joint Industry and City Waste Treatment: Collection System and Treatment Works." By J. K. Latham and J. W. Finney, Jr., Howard K. Bell Consulting Engineers, Lexington, Ky., *Journal Water Pollution Control Federation*, February, 1960.

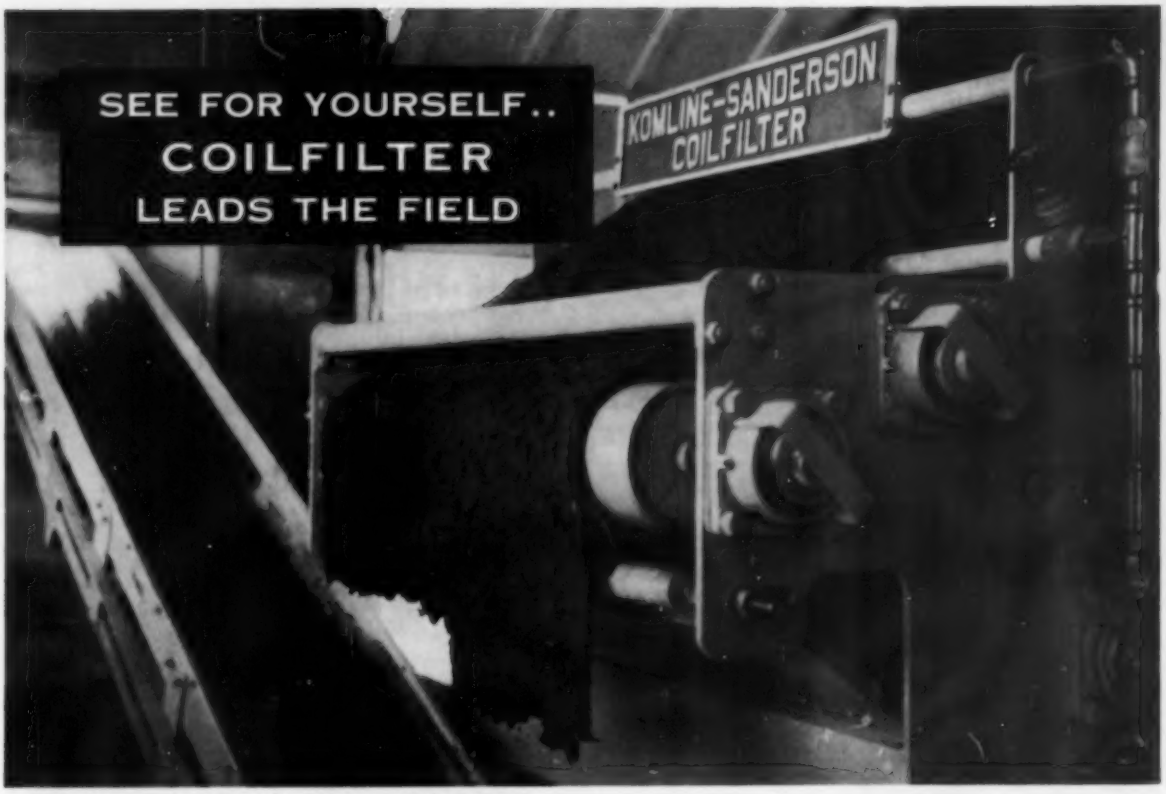
Toxicity of Rare Chemicals

A survey of the literature revealed that adequate data are available on the toxicity of common metals to fishes as determined by bioassay procedures. In connection with the use and production of atomic energy, a number of compounds will be used which have heretofore been only rarely found. Accordingly studies were made to establish median tolerance limits for fathead minnows and bluegills in soft and hard water in the presence of compounds of beryllium, uranium, zirconium, titanium, vanadium, molybdenum and antimony as well as nickelous chloride, lead chloride and copper sulfate. Beryllium was found to be the most toxic with a 96-hr. median tolerance limit as low as 0.2 mg/L in soft water. That for uranium was also low, about 3 mg/L. Values for the others ranged from 5 to 15 mg/L.

"Toxicity of Less Common Metals." By C. M. Tarzwell and C. Henderson, R. A. Taft Sanitary Engineering Center. *Industrial Wastes*, February, 1960.

Chemical Treatment For Board Mill Wastes

Field and laboratory investigation of the waste discharges from two midwestern board mills to provide treatment plant design criteria included the possibility of chemical coagulation of wastes. It was found that the unit effluent discharge was



Illustrated above: Cozad, Neb., plant. Engineers: Nesky & Hickey

Exaggerated claims by others notwithstanding, the fact remains that there are more Komline-Sanderson COILFILTERS in trouble-free operation than any other sludge dewatering device. COILFILTER success is based upon performance, not claims. This performance is shown in readily available plant operating data. Each installation, more than anything written, proves COILFILTER superiority.

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11,000 gallons per ton with a BOD exertion of 15.5 lbs. per ton of board produced and a suspended solids load of 29.5 lbs. per ton. The BOD velocity constant was high at 0.17. Continuous flow settling tanks can be expected to remove about 70 percent of the mill solids after a detention time of 60 to 90 minutes, with an accompanying BOD reduction of about 11 percent. Coagulation with iron and aluminum salts with or without coagulant aids results in BOD removal limited to that existing in suspended form. About 100 ppm of coagulant is required. It is believed that biological treatment would be required to effect BOD removals in excess of 30 percent and oxygen demand rates would be considerably higher than those resulting from treatment of domestic sewage.

"How Effective Is Chemical Treatment of Board Mill Process Effluents?" By Thomas P. Quirk, Malcolm Pirnie Engineers, New York. *Wastes Engineering*, February, 1960.

Surcharges for Industrial Wastes

About 40 percent of the treatment facilities of the Allegheny County (Pa.) Sanitary Authority will be used for industrial wastes. This required the establishment of an equitable system of surcharges for handling wastes of excessive strength. All wastes originating within the area served by the plant are accepted, with the exception of pickle liquor wastes and acid mine drainage. Limitations are placed on other toxic and deleterious wastes. Pretreatment is sometimes required. The Authority charges a premium above the regular sewer service charge, based on suspended solids over 275 ppm, BOD more than 300 ppm, chlorine demand exceeding 5 ppm, high or low pH and color. One surcharge formula assesses the proportion of the excessive suspended solids at a greater rate than the proportion of the excessive BOD. That for chlorine demand is based on the prevailing purchase price of chlorine. Regular service charges are on the basis of water use. The treatment plant consists of screens, grit chambers, preaeration and sedimentation tanks, sludge concentration tanks, incinerators and chlorination facilities. A staff of ten technicians is employed to sample industrial discharge and domestic sewage flows at more than 280 diversion structures spread over 200 square miles.

"Setting Fair Sewer Service Rates for Sewage and Industrial Wastes." By J. F. Laboon and R. J. Dougherty, Executive Director and Chief Construction Engineer, Allegheny County Sanitary Authority, Pittsburgh, Pa. *Wastes Engineering*, February, 1960.

Corn Chip Wastes

Wastes from a corn chip manufacturing plant were analyzed to determine the possible pollution load from the process. Data obtained on materials and production included weight of corn processed and solid content, weight of chips produced and oil and moisture content of the finished chips. Results were compiled on the basis of a production unit of 1,000 lb. of corn processed. A determination was made of the 5-day BOD of whole corn, permitting correlation of the observed BOD in the sewer with that estimated from the loss of corn solids. It was found that for each pound of dry corn solids a 5-day BOD of 0.575 lb. will be exerted. It was indicated that a solids balance could be used for estimating strength, the BOD being determined from the weight of corn processed, percent dry weight of the corn, weight of dry solids produced and the BOD exerted per dry pound of

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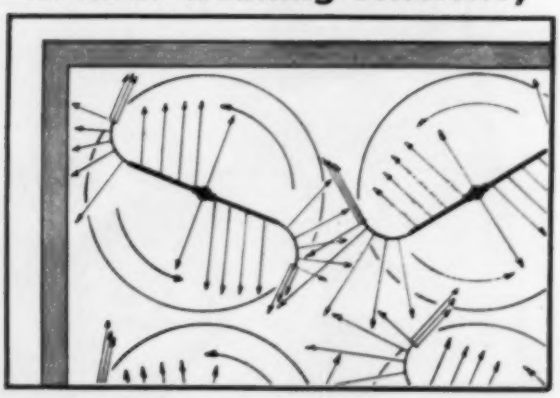

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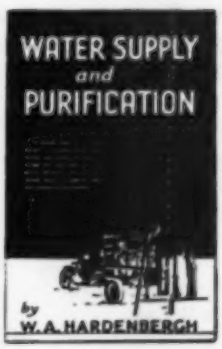

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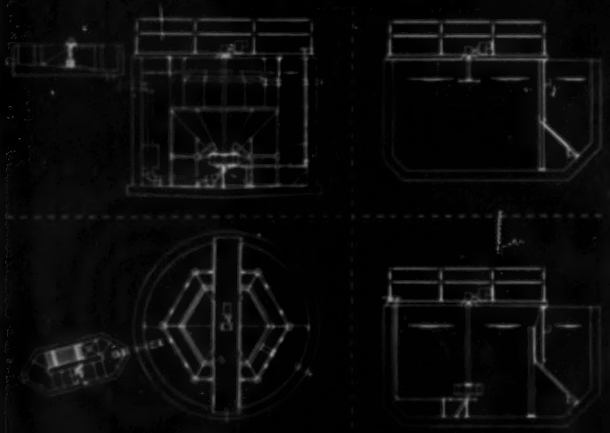

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dry solids. Water is used primarily for soaking and washing the corn, for washing equipment and for cleanup. Discharge to municipal sewerage when available is probably the best disposal method. Otherwise stabilization ponds, land application, spray irrigation or trickling filters are indicated.

"Wastes from the Processing of Corn Chips." By Ralph Porges, R. A. Taft Sanitary Engineering Center. *Journal Water Pollution Control Federation*, February, 1960.

Other Articles

"Utilization of **Spent Sulfite Liquor.**" By J. M. Holderby and W. A. Moggio, St. Regis Paper Co., Rhinelander, Wis. The Rhinelander Paper Co. manufactures yeast and calcium lignosulfonates from spent sulfite liquor and markets these products through another subsidiary of the St. Regis Paper Co. Journal Water Pollution Control Federation, February, 1960.

"Sampling and Flow **Measuring Devices** for Plant Surveys." By Paul B. Hodges, Monsanto Chemical Co. Instruments are described which are specifically designed to overcome obstacles in field analysis of industrial waste problems. Industrial Wastes, February, 1960.

"**Air Pollution**—Its Effects, Control and Abatement." By D. A. Irwin, Medical Director, Aluminum Co. of America. The position of the medical man is discussed with regard to the need for further research particularly on the synergistic effect of fine particulate and toxic material. Industrial Wastes, February, 1960.

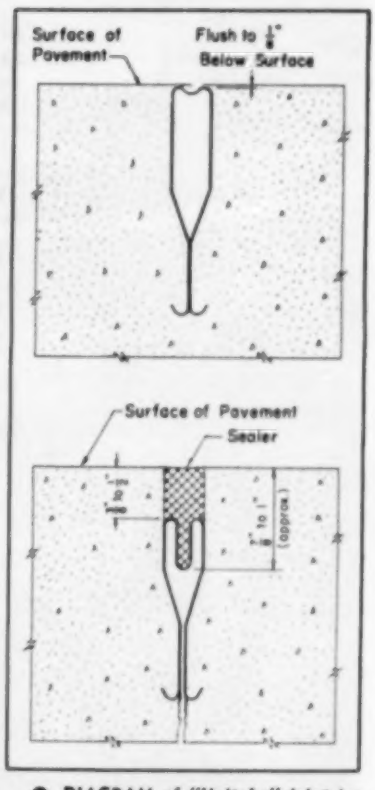
JOINT-FORMING METHOD FOR PAVEMENTS

TWELVE months ago, a small Baltimore firm, which specializes in joint forming on highway and airport paving jobs, proposed to obtain the necessary plane of weakness in a slab of concrete by means of a unique joint former inserted directly into the fresh pavement after pouring and machine finishing. The theory was that the hollow metal insert would not only create the joint where desired during contraction, but also would produce a joint with distinct design features at substantial savings in installation costs. After a year of laboratory tests and experience on over 40 installations, the technique has won engineering approval.

The insert developed by Middlestadt (called "Unitube") is a hollow strip of lightweight galvanized steel. The top is ⅜-inch wide. The 2¼-in. sides taper together at the bottom to permit easy insertion into the wet concrete. Each of these flanges turns outward and upward at the bottom to form a claw, imbedding each side of the flexible metal insert to a slab so that it spreads when cracking occurs.

The folded metal strips are produced in 2-in. and 3-in. depths, also, to meet various state and government specifications and are pre-cut to desired lengths. Ten-foot lengths, which interlock end-to-end, are installed to form the longitudinal joint. Transverse joints are placed from the side forms to the centerline where they butt against the longitudinal joint.

A two-man crew works from a specially designed rig—dubbed "The Planter"—which rides the forms behind the contractor's paving train. This machine provides guides for accurate placement of the Unitube and a vibrating "T-Bar" device is used to form a groove in the fresh concrete and then push the Unitube to the proper depth. The ⅜-inch-



● **DIAGRAM of "Unitube" joint insert shows position immediately after installation, at top; and after crimping and sealing of the joint at the bottom.**

wide flat top is left flush with the finished surface.

A one-man operated mechanical vibrating machine called a "Crimper" is run down each joint, after the curing period, folding the top of the metal tube inward and downward. This produces a joint ½-inch deep to carry the sealing compound. Sealing is accomplished by normal methods.

The major design advantage is that the folded metal insert creates a joint depression of the right size. Recent research has established the fact that a sealing compound in a groove that is wider and shallower than the traditional deep narrow cut suffers far less internal strain when the opposing slabs contract, and is thus less likely to fail and lose its bond to the concrete.

The Middlestadt Corporation reports that production facilities are being expanded to meet a demand for $1 million worth of the metal inserts this year. The company also manufactures the equipment needed for installation.

• • •

Public Works Equipment in Needham

The 1959 annual report of Needham, Mass., lists the following equipment of the Department of Public Works: 5 passenger cars; 2 station wagons; 28 trucks; 13 tractors; 3 air compressors; 2 rollers; 1 sweeper; 2 leaf and refuse collectors; 3 power shovels; 1 road grader; 18 material spreaders; 2 cement mixers; 1 trailer mower; 1 triplex power mower; 3 single power mowers; 1 cultivator; 1 brush chipper; 1 compost grinder; 2 mist sprayers; 2 swing fog sprayers; 1 hydraulic sprayer; 5 sewer cleaning units; 5 trench pumps; 2 fire pumps; 20 plows for trucks and tractors; 1 litter "shark"; 1 snow thrower; 3 chain saws; 1 generator; and miscellaneous other small equipment.

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A man with approximately ten years of experience in the valve industry first as manager of a valve sales department, later division manager responsible for sales, engineering and manufacturing, is available. His broad experience in sales is generally applicable to other typical engineered products as well as to valves. Write to Box 4-1, Public Works Magazine, 200 South Broad St., Ridgewood, New Jersey, who will forward all inquiries.

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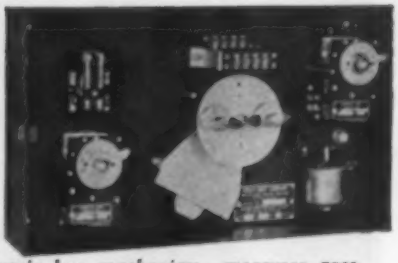

Healy-Ruff Company offers a complete line of easy-to-install, simple-to-use pressure-sensing controls for water works and sewage fields. Control only, or indicating and recording as well, can be supplied. All systems incorporate these desirable features:

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THE PW ROTOTROL controls both pressure and water level in hydropneumatic tanks. Cuts off pumps on either high pressure or high level Air-add or air-release types. *Bulletin PW-6*

THE RPS ROTOTROL controls level in pumping stations, sewage plants or reservoirs. Senses level change through corresponding change of pressure in compression bell submerged in wet well. Purged air or compression pipe types. *Bulletins RPS and RS3*

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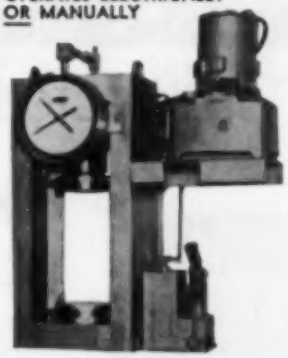

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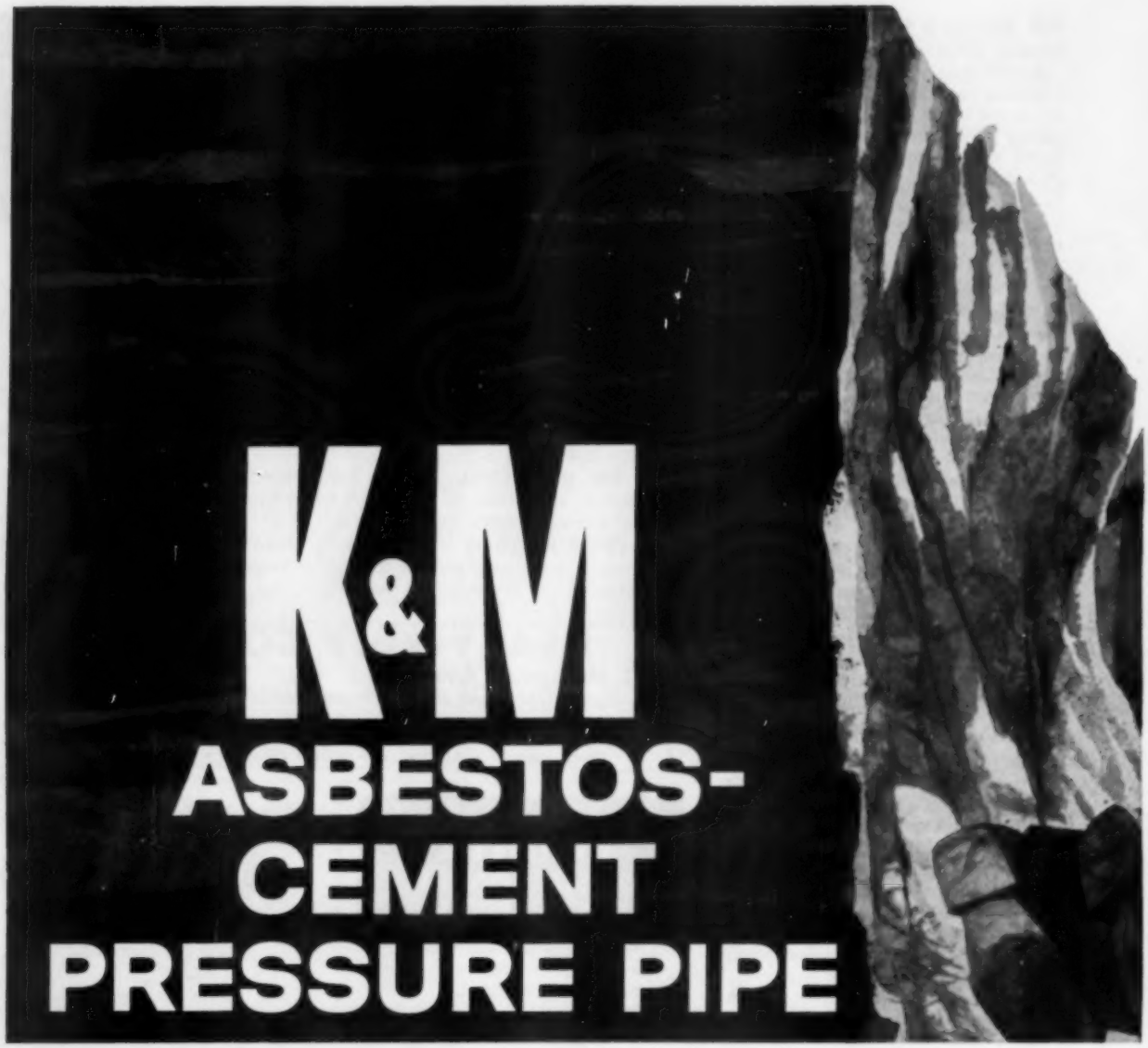
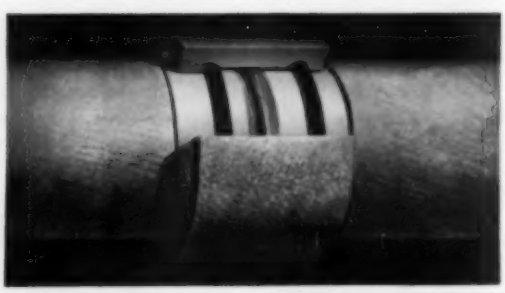


its bore stays clean year after year



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REPLACEMENT of narrow and understrength bridges has been greatly simplified by the development of pre-fabricated bridge decks. Since many of these bridges are supported on piles, the piles must be redriven and fitted with concrete caps to support the new decks. Heretofore it has been necessary to erect forms and place concrete at the bridge site in order to provide pile caps upon which the prefabricated bridge deck could be placed. By use of a two-piece precast concrete pile cap, the placing of concrete in the field is eliminated.

The caps are made in two interlocking pieces which are L-shaped in cross section. By separating the precast cap into two pieces, several advantages resulted. First, the weight of each L-shaped piece of a 24-ft. long cap is under 4 tons; second, the piece that is set on the piling has the pile sockets visible from the side; and third, the final piece of the cap is held in place by horizontal bolts which pass through both pieces and clamp the interlocking pieces to the pile heads. The caps are made with pressure grouting holes so that all space around the pile heads within the sockets may be filled with non-shrinking grout.

Single span, precast concrete decks can be erected in one day by the use of these precast caps on piling previously driven.

Information on these caps is available from MORE Service, 384 So. Cotner Blvd., Lincoln 10, Nebraska.

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Brush Control on TVA Rights-of-Way

The TVA power system included 11,728 miles of energized transmission lines at the end of the 1959 fiscal year, and it is estimated that this will increase to 11,933 miles during fiscal 1960. About 60 percent of the rights-of-way run through wooded areas, resulting in approximately 80,000 acres of brush to be controlled.

Right-of-way brush control is the greatest and most expensive problem in the maintenance of transmission lines, in most instances. During the first 15 years of TVA operation, brush was cleared by large crews using hand tools. Labor costs constantly increased. Rotary brush cutters, bushwackers and power saws have also been used. Both hand and mechanical methods have the same disadvantage—roots are not killed and regrowth from stubble and stumps becomes more prolific after each clearing operation.

In 1949, TVA started using chemicals for right-of-way maintenance. During 1959 automatic spray nozzles mounted on army-type trucks and helicopters were used extensively. A skilled truck driver can cover a high percentage of the TVA transmission line rights-of-way with very few acres of brush skipped—less than 10 percent.

The helicopter is especially adapted to difficult terrain, such as mountains and swamps. In these areas it can operate at a cost far below any other brush control method. The downward movement of air from the rotor causes the chemical to penetrate the growth to ground level and also aids in confining the chemical moisture to the right-of-way, helping to minimize damage to adjacent crops.

We do not claim that the automatic spray nozzle and the helicopter are the universal answers to the application of chemicals, and they will not eliminate the use of ground crews for conventional foliage and basal treatment. However, they serve a real need in the right-of-way maintenance program. We have observed that the automatic spray nozzle gives a slightly higher percentage of root kill than the helicopter.

Through chemical treatment and new methods of application, 25 percent more transmission line right-of-way was cleared last year. Expense was reduced more than 10 percent at the same time.

From a paper by R. A. Mann, TVA.

NICHOLS offers

Nerco
"ROTO-PLUG" SLUDGE CONCENTRATOR
Edco

Nichols Engineering & Research Corporation is pleased to offer the Nerco-Edco "Roto-Plug" Sludge Concentrator for municipal and industrial sludge dewatering.

Through the use of the "Roto-Plug" Sludge Concentrator, sewage sludge and many industrial sludges can be thickened and dewatered without the use of chemicals and with only about 1/10 of the power customarily required for mechanical dewatering.

Here is a remarkably simple method which operates continuously and automatically, and does not require a technically trained operator.

No longer is mechanical dewatering of sludge limited to the large sewage treatment plants with budgets and technically trained operators to match, for here is equipment which eliminates the use of chemicals, the cost of storing and handling chemicals, the need for air compressors and vacuum pumps, and high filter media maintenance cost.

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For complete details write for four page technical bulletin "RP-100":

•

NICHOLS ENGINEERING & RESEARCH CORP.
80 Pine Street, New York 5, New York
3513 N. Hovey Street, Indianapolis 18, Ind.
405 Montgomery Street, San Francisco, Calif.

SNOW REMOVAL in the ROCKIES

SNOW REMOVAL problems assume large proportions on highways crossing the Rocky Mountains, and considerable effort is required to keep the roads passable during the winter months.

Typical of the heavy-duty equipment developed to handle deep snowfalls and snowslides is the Snowblast rotary snowplow manufactured by the American Snowblast Corp. of Denver, Colorado. The following information on the performance of one of these units has been furnished by Chas. E. Shumate, Asst. Chief Engineer of the Colorado Department of Highways.

The Snowblast rotary snowplow was delivered to our State in March of 1958. The machine was credited with having superior characteristics in all snow removal work; however, the equipment was purchased by us on a performance or money back basis.

The first test on it was a demonstration at Leadville, Colorado, where it removed up to 2,250 tons of snow per hour. The unit was later sent to operate on U.S. Route 550 north of Durango, the area of our heaviest snowfall.

Shortly after it arrived at that location it was put to work on one of the largest avalanches to cross our highways in the past several years. The maximum depth of the avalanche was fifty-four feet, and it was approximately two thousand feet long. We used two D-7 tractors and dozers to feed the Snowblast and the rotary was able to handle all the material these two units could put into it.

This particular unit, of course, is quite different in design from previous rotary plows inasmuch as the truck power unit is mounted behind the cab which gives the operator superior visibility and much better control. Also, we feel that we have a much better weight distribution on the axles than with the conventional unit. Maintenance on the unit has been quite nominal.

● **AVALANCHE 54 feet deep and 2,000 ft. long was cut through. Two D7 tractors and bulldozers were required to feed the Snowblast. View shows rugged country.**

● **SNOW removal by the Snowblast in an area of very heavy snowfall. In a demonstration near Leadville, the machine was able to remove 2,250 tons of snow per hour.**

● **ROTARY snow plow owned by the Colorado Department of Highways was delivered in March, 1958. It has been highly satisfactory and maintenance costs have been nominal. Superior operator visibility and easy control are included among its many advantages.**

It's a fact...

PACKER BODIES Cost 1/3 Less Than Rear Loading Units of the Same Rated Capacity, Yet Hold Yards More of Compacted Refuse!

How is this possible? The answer is *simplicity* of design and operation. First, the M-B Packer costs ⅓ less because there is no heavy, complicated hydraulic tailgate involved. A simple, powerful packer plate moves through the entire length of the body compacting all types of refuse — then quickly pushes out the load through the big rear doors. Secondly, the new vertical packer plate design allows up to *4 cu. yds. of useable area above the rated compacted capacity of the body!*

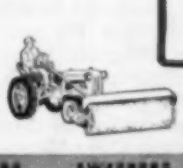
Because of M-B's square, van-type body design which eliminates dead weight, the compactor body can be mounted on a low-cost, popular size truck chassis with resultant savings in lower operating and maintenance costs.

There's a size for every need: 14 to 24 cu. yd. truck mounted; 32 and 38 cu. yd. in both the Trail-Pack, self-powered trailer type models and the M-B Contain-O-Pack Self-Loading Packer system for "containerized" refuse handling.
From every angle, you're dollars ahead with M-B Packer Bodies — the choice of hundreds of private haulers and municipalities.

Money-Making Features

- **FAST OPERATION:** rugged, bulldozer-type packer plate thoroughly compacts refuse, garbage and trash . . . the complete cycle takes only a few seconds.
- **COMPLETE SAFETY** because of side loading from the curb, eliminating danger to collectors from passing traffic. All compaction mechanism located inside the body — safely out of operator's reach.
- **PACKS ANYTHING** — barrels, crates, cartons, etc. without pre-crushing. Use as general purpose truck for hauling snow, ashes, park equipment, nursery stock, leaves, etc.
- **CONTROLLED DUMPING:** full load is pushed out quickly and safely by packer plate *without raising the body* as in hydraulic-type units.
- **LESS DEPRECIATION** — low truck cost, low body cost and less wear and tear adds up to less depreciation of your original investment.
- **MORE BLOCK COVERAGE** — progressive compaction, easy loading means more tonnage per load — fewer trips to the dump or incinerator.

The proof is in a demonstration. See your distributor or write the M-B Corporation, New Holstein, Wisconsin.



M-B CORPORATION
NEW HOLSTEIN, WIS.

Manufacturers of Quality Municipal and Construction Equipment Since 1907

PACKER BODIES LINE MARKERS SWEEPERS

Central Stores Organization and Operation

ANDREW L. LEHRBAUMMER,
City Purchasing Agent,
Milwaukee, Wisconsin

This article is based on a paper presented at the National Institute of Governmental Purchasing Conference in Cleveland, Ohio, in October, 1959.

FOR MANY years the Purchasing Department of the City of Milwaukee maintained a storehouse for the distribution of common use items to all of the departments. The location was shifted from time to time but none of the locations had adequate facilities or space to realize the full potential savings of a modern warehouse. This drew the attention of the Citizens Governmental Research Bureau Inc. of Milwaukee which received authority from the Central Board of Purchases to have a study made for a comprehensive stores and control system for the City of Milwaukee. This group provided the funds for this work as a civic interest; the study was made by Albert Pleydell, then Commissioner of Purchases of the City of New York. As a result, funds were appropriated to establish a central storehouse for articles of general use. Among the other recommendations of the study were: 1) To establish a centralized authority over all storehouses; 2) to consolidate as many city storehouses as may be practicable; 3) to develop a stock control system for all storehouses and storerooms; and 4) to allocate properly types of stock in storehouses and storerooms to prevent double-handling and overstocking.

New Municipal Warehouse

The new municipal warehouse was dedicated in 1953. This cost $160,000; the floor area is 22,000 square feet and the volume 320,000 cubic feet. There is a loading height of 19 feet except in the mezzanine section which is used to store articles in small quantities and sizes. The average value of stock carried is approximately $100,000. We had hoped to have an average turnover of three times annually. However, since the warehouse was opened, we have averaged a turnover of approximately twice annually.

A petroleum plant is operated in conjunction with the municipal warehouse. This has two 250,000-gallon gasoline tanks for regular and premium and three 15,000-gallon tanks for motor oil and kerosene. Deliveries are made on a schedule to departments which do not have facilities for handling transport or tank car quantities. The turnover of this stock is approximately four times per year.

Advantages

By having a municipal warehouse, the clerical work involved in purchasing is reduced and a degree of standardization is accomplished. There are fewer transactions and deliveries involved in the event of complaint or rejection. Buying is improved as 1) consolidation of requirements leads to better prices; 2) there is only one transaction to watch to earn a cash discount. Custodial storage for property belonging to other departments is accommodated. Goods are on hand when needed, and delay of a project is prevented by maintaining control of stock. It is possible to provide adequate inspection of large lots, whereas it is not economical or practicable to test several small deliveries at various locations. Costs are lower because a well laid out warehouse equipped with modern materials handling equipment and run in accordance with good management practices, is more efficient. Control minimizes obsolescence. Quantity buying results in saving.

Typical examples are as follows: Regular gasoline, 100,000 gals., was recently bought for tank storage at 11.9¢ per gal.; wholesale tank truck price is 13.89¢ per gal.;—saving—approximately 16 percent. Mimeograph paper, 8½ x 11, 20-lb., No. 1 white sulphite—500 reams was purchased for storehouse at 1.33¢. Purchases of 1 to 10 reams cost 2.84. Saving was approximately 113 percent. Tracing paper, Clearprint—#1000H-36" x 20 yd.; 12 roll lots are in stock at $5.56. Single roll purchases are $6.95. Saving is 20 percent.

Motor oil purchased in 8,000 gal. tank cars averaged 27¢ per gallon for the highest grade heavy duty detergent oil complying with U. S. Army specification. This would cost about 70¢ per gallon in drum lots. (Consumers pay about 50¢ per quart for this grade at corner filling stations.) Saving is approximately 250 percent.

Cost of Operation

All contributing costs of operating a warehouse should be computed. These include salaries of employees; motor vehicle rentals; electric power, heat, consumable supplies, repairs, insurance and water. Interest on investment should be determined, taking into consideration average stock value, buildings value, equipment value, and grounds value. The interest rate is based on the present cost of loans to the agency. Depreciation of the building is based on a 60-year life; on equipment, 20-year life. This total cost should then be compared with the gross saving which is estimated at 30 percent of the value of the goods handled.

Operation

A Stores Manual of Procedure has been prepared for the purpose of standardizing warehouse, storeroom and storeyard procedures of all City stores locations. It details all of the requisites under the following headings: Inventory; requisitioning; receiving and inspection; protection (stock, buildings, equipment and personnel); issue of stock; material handling; accounting; stock catalog; obsolescence and utilization of space. Standard forms and uniform procedures are employed in the Municipal Warehouse as well as in all the storehouses of the City.

A catalog has been prepared and distributed among all City departments and other interested people. This is in loose leaf form so that new pages may readily be inserted and old ones discarded thus keeping the catalog up to date.

Maintenance

It is important that good housekeeping throughout a municipal warehouse prevail at all times. Constant care must be exercised to keep the building and stocks in a manner that will provide good utilization, attractive appearance and operating efficiency.

This applies to the grounds as well, which should make the warehouse an asset to any location. Planting and landscaping should be carefully planned and regular maintenance should keep the outside well groomed and pleasing in appearance.

APWA News Bulletins

(*Continued from page 124*)

out that a minimum of a 6-year street plan is required to assure continuity and allow proper time for purchase of right-of-way, engineering and construction. Raymond Andrysiak, city engineer of South Bend, commented on the success of street planning in that city.

A talk on "The Objectives of APWA" was given by Lloyd A. Dove, APWA Director of Research, at the noon luncheon. It was pointed out that APWA serves its membership in many ways—through chapter meetings, research publications, the monthly News Letter, the annual Congress and Equipment Show, committee activities and the inquiry service.

North Dakota Chapter Elects New Officers

Grand Forks, N. D.—Don Wenaas, city engineer, Jamestown, N. D., became the North Dakota Chapter's new president at the Feb. 12 meeting in Grand Forks. C. M. Hagen, director of public works, Oakes, was elected vice-president, and Vern Fahy, director of public works, Minot, N. D., was elected secretary-treasurer. New members to the Board are W. B. Lukens, assistant city engineer, Bismarck, and Thoburn Peterson, assistant city engineer, Grand Forks.

In his welcoming address at the Grand Forks Municipal Armory, Mayor Oscar Lunseth emphasized the importance which municipal officials should attach to minor complaints of citizens.

The importance of the Garrison Diversion project to the future of North Dakota was outlined by State Water Commissioner Milo Hoisveen. Hoisveen spent almost an hour following his talk answering questions and elaborating on the project. The luncheon speaker, George Michaelson, field representative of the North Dakota Heart Association, spoke on the elements that go into a good public relations program.

In the afternoon an open forum was conducted on "Planning of Public Works."

Future APWA Chapter Meetings

Alabama-Georgia Chapters (Joint Meeting)
May 5-6;—Columbus, Ga.
Sec'y.-Treas. — Rex R. McGinnis, Birmingham, Ala., Room 310, City Hall, Birmingham, Alabama

Chicago Metropolitan Chapter
May 19; Midwest Country Club
Sec'y.-Treas.—Thomas J. Petrick, 3624 W. 59th Pl., Chicago 9, Ill.

Florida Chapter
Inaugural Meeting
May 6; Orlando, Florida
District Representative: Paul Jorgenson, City Engineer, Municipal Building, St. Petersburg, Fla.

Michigan Chapter
April 21—Lansing, Mich.
Sec'y.-Treas.—Frederick Mammel, City Hall, Ann Arbor, Michigan

New Orleans Chaper
May 4—New Orleans, La.
Sec'y.-Treas.—John J. Porte, Room 5W03, City Hall, Civic Center, New Orleans, La.

New York—New Jersey Chapter
May 11—Village of Hempstead, N.Y.
Sec'y.-Treas.—Elroy F. Spitzer, 470 Fourth Avenue, New York, New York

Ohio Chapter
April 21—22; Akron, Ohio
Sec'y.-Treas.—Joseph C. Webber, 1430 Shenandoah Road, Toledo 7, Ohio

WATER MEASUREMENT

...accurate
easy to read

PARSHALL MEASURING FLUME
For open channels in industrial plants, waterworks, irrigation systems and sewage disposal plants. Galvanized steel.

- Self-cleaning
- Easy to read
- Low head loss
- Throat widths: 3" to 10'

AUTOMATIC CONTROL GATES
Regulate flow and water levels regardless of water supply variation. Ends need for 24-hour supervision . . . prevents waste, flood damage and overflow. No floats, sheaves, motors or cables.

WELL CASING Scientifically designed for all soil conditions. Made of mild, stainless and alloy steels for long life and low initial cost. Five perforations and four field joints for fast assembly. Write for free literature.

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How Mud-Jack® corrects sunken slabs

Want an easy, low-cost way to raise settled sidewalks, street slabs, curbs, gutters, driveway approaches? Check Koehring® Mud-Jack. It pumps soil-cement slurry under pressure into small holes drilled through pavement. This displaces air pockets, water or water saturated materials — *raises the concrete slab* — leaves firm permanent sub-grade. Two sizes available: A small portable Mud-Jack for cities, a larger model for maintenance, low-cost repairs on highways.

KOEHRING DIV., Milwaukee 16, Wis. *Send us new Mud-Jack catalog*

NAME_____
TITLE_____
DEPARTMENT_____
STREET_____
CITY, STATE_____ KOOS PW

Texas Chapter
May 2-3; Lubbock, Texas
Sec'y.-Treas.—Jack Graham, P. O. Box 1622, Corpus Christi, Texas

Upstate New York Chapter
May 1-3; Ithaca, New York
Sec'y.-Treas.—Paul Fidler, Dept. of Public Works, City Hall, Ithaca, New York

Washington State Chapter
May 10-11; Wenatchee, Wash.
Sec'y.-Treas.—Earl Elton, City Engineer, City Hall, Bremerton, Wash.

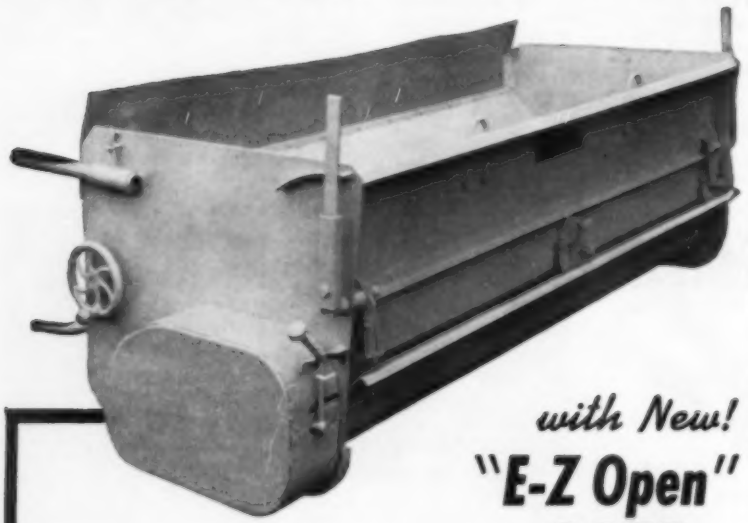
Western Pennsylvania Chapter
May 20; Pittsburgh, Pa.
Corr. Sec'y., Joseph James, Institute of Local Government, University of Pittsburgh, Pittsburgh, Pennsylvania.

Western Public Works Conference
May 16-18; Fresno, Calif.
Sec'y.-Treas. (Central California Chapter) J. E. Fitzgerald 1455 Van Ness Ave., Fresno, Calif.

Wisconsin Chapter
May 19-20; Oshkosh, Wis.
Sec'y.-Treas.—John G. Thompson, 202 Monona Ave., Madison 9, Wisconsin.

Virginia—D.C.—Maryland Chapter
April 22-23; Alexandria, Va.
Sec'y.-Treas.—Donald S. Frady, Dept. of Public Works, 151 E. Broad St., Falls Church, Va.

SPREAD CHIPS FASTER, EASIER!



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"E-Z Open" GATE

STANDARD STEEL'S new spreader with all these features:

- Simple, low maintenance chain transmission
- "E-Z Open" gate swings away from box, carries no load
- Heavy duty, positive locking truck hitch
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- 0 to 2¾" full or tapered spread
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ASPHALT DISTRIBUTORS . . . BURNERS . . . POWER AND TRACTION DRIVEN CONSTRUCTION BROOMS . . . MAINTENANCE DISTRIBUTORS . . . TAR KETTLES . . . AGGREGATE SPREADERS STREET FLUSHERS . . . PIPE LINE EQUIPMENT . . . SUPPLY TANKS SHELVING HARDWARE . . . AND AGRICULTURAL EQUIPMENT

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HIGHWAY ENGINEERING

This is the second edition of a book that has been widely used in college instruction and also as a reference text. The authors have had extensive experience in teaching and in field work and have incorporated in this new edition information on major advances in the field, including, according to the publisher's announcement: Highway cost-benefit calculations; geometric designs current with AASHO and Interstate System policies; soil engineering; hydraulic design of open channels and culverts; aerial photography and electronic computers; etc. By Leo J. Ritter, Jr., Associate Editor, Engineering News-Record, and Radnor J. Paquette, Prof. of Civil Engineering, Georgia Institute of Technology. The Ronald Press Co., 15 East 26th St., New York 10, N. Y. $10.

PAVING THE WAY

This is an interesting and informative booklet presenting a progress report on the 4-year activities of the Philadelphia Department of Streets for 1958-1959. David M. Smallwood, City Hall, is Street Commissioner.

CIVIL ENGINEER DESIGN DATA BOOK

This is a completely revised third edition of Vol. 1 of a highly useful series of books. Assuming that many of our readers are not familiar with the book, we can state there are 25 sections, covering a very wide range of design: Structural, general and concrete; rigid frames; structural steel, aluminum and wood; structural formulas; soils; pavements, roads, streets and bridges; airports; dams; drainage and sewerage; sewage treatment; water supply, purification and distribution; and athletic fields are some of the subjects covered. In this new edition, material has been added on: Prestressed concrete, composite beam design, wind pressures, pavement design, highway geometrics, airport design,

sludge heating, bridge design and waterfront engineering.

The dimensions of this book are slightly greater than those of PUBLIC WORKS—it is no pocketbook; and it weighs 5 pounds. The author is Elwyn E. Seelye; publisher is John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price is $24.

75 YEARS OF CLAY PIPE HISTORY

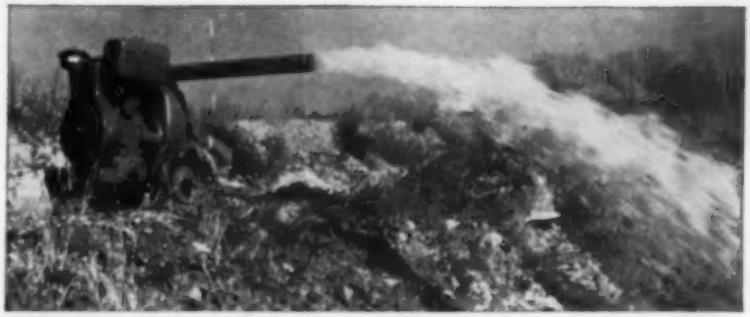
In 1960, the W. S. Dickey Clay Mfg. Co. completes 75 years of clay pipe history. This diamond anniversary number of "Dickey Data" carries a good deal of interesting material on the changes and improvements in clay pipe making since 1885, as well as other information on the development of sewerage to meet the needs of our modern way of life. W. S. Dickey Clay Mfg. Co., Box 2028, Kansas City 42, Mo.

COMPOSTING OF ORGANIC WASTES

In connection with their research on composting, the Technical Development Laboratories of the Communicable Disease Center made a survey of the literature on the subject. Abstracts of all printed material, including foreign publications, have been compiled as an annotated bibliography. The material has been carefully edited and well indexed by John S. Wiley of CDC and reproduced in mimeographed form. The original compilation is dated February, 1958 and contains 128 pages. A supplement, with 65 pages, was reproduced in June, 1959. The bibliographies are intended for those interested in composting research or in the technical phases of composting municipal wastes. They will not be of assistance to those interested in farm or home composting methods. "Composting of Organic Wastes —an Annotated Bibliography" and "Supplement 1" are available upon request, subject to the foregoing limitations. Requests should be addressed to Lawrence B. Hall, at the Technical Development Laboratories, Communicable Disease Center, Post Office Box 769, Savannah, Georgia.

YOUR JOB WITH IOWA CITY

This personnel handbook, sent us by Peter F. Roan, City Manager, Iowa City, Iowa, is an excellent presentation of the rights, privileges and obligations of city employees. It covers organization of the city government; working hours; overtime;



It's Jaeger's new 3" pump . . . the "3PN"

Out-performs all previous models

Pumps all the water a 3" suction hose can handle. With 4" suction hose pumps 28,000 gph at 10' lift. Sure-priming is correspondingly fast, at all practical lifts.

AND LOOK HOW EASY TO MAINTAIN!

Suction chamber and liner are removable for quick adjustment, rotation or replacement of liner plate. (New Model 3XPN offers same feature in a smaller pump.) See your Jaeger distributor or send for catalog.

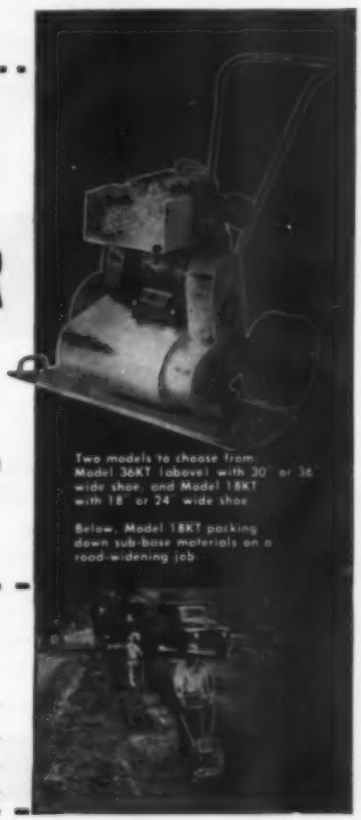
THE JAEGER MACHINE CO., 400 Dublin Avenue, Columbus 16, Ohio

AIR COMPRESSORS • MIXERS • PAVING, SPREADERS and FINISHERS

PACK, PACK, PACK . . .

with the Kelley

POWER TAMPER



Twenty-four hundred times a minute the Kelley 36KT Power Tamper hits with a force of tons, with the compacting force of a massive power roller. But Kelley Power Tampers are handier than rollers. They can pack earth backfill to maximum density next to foundations, piers, in pipeline trenches, on road jobs, etc. Also for finishing blacktop, with heater shoe attachment available.

Two models to choose from: Model 36KT (above) with 30" or 36" wide shoe, and Model 18KT with 18" or 24" wide shoe.

Below, Model 18KT packing down sub-base materials on a road-widening job.

Kelley **MACHINE DIVISION**
The Wiesner-Rapp Co., Inc.
285 Chicago St.
Buffalo 4, N. Y.

Please send us information on Kelley Tampers.

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paydays and payroll deductions; retirement and pension plans, vacations; holidays, sick leave and other leaves; workmen's compensation; promotion, demotion, transfer and resignation; political activity, telephone use and rest periods; and outside employment; 24 pages; 4¼ x 5½ inches; published in 3 colors.

ELECTRONIC COMPUTERS IN HIGHWAY OPERATIONS

This is a 160-page mimeographed book containing a complete copy of all reports presented at the AASHO Electronics Committee meetings in Boston in Oct., 1959. The papers presented covered: Programs in use and under development; use in bridge design; experiences with digital cross-sectioning; income and expenditure computations; highway sufficiency rating computations; traffic projection and assignment; cost-benefit ratio computations; development of digital model system of highway location; computer use in Massachusetts; and panel discussions on the organization and operation of an electronic computer center. Also covered is the General Motors Highway Information System; progress in electronic vehicle detection; recording and computing the characteristics of moving vehicles; and the Michigan nuclear combination density-moisture surface gage. No price is quoted. For further information write the Secretary of the AASHO Committee, Division of Development, Office of Operations, Bureau of Public Roads, Washington 25, D. C.

For your town . . .
A MODERN Standard Steel
FLOATING BOAT MARINA
At Hannibal, Mo. — 800-foot Floating Marina handles 112 boats, serves gas, oil, refreshments.
Help boost your community to Leadership in today's BOATING BOOM!
Check STANDARD STEEL Now for the finest, safest, strongest, most modern boat marinas — at lowest cost! Pre-planned, pre-fabricated for quick installation and years of rugged service, they pay for themselves quickly out of revenue.
No obligation . . . Write or phone for consultation with our qualified marina engineer on marina planning.
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FLOATING DOCKS, PIERS, BOAT SLIPS, SERVICE PATIOS, RAMPS, STAIRWAYS, BOAT CANOPIES, COMPLETE ACCESSORIES
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LEADERS IN MODERN ALL-STEEL WATERFRONT EQUIPMENT

OPPORTUNITIES IN ENGINEERING

In your 1956 publications of March, May and July you ran a series entitled, "Opportunities in Civil and Public Works Engineering."

If reprints of these articles are still available, I would like to have a copy of each. I intend to use the articles as reference material for a TV series on "Engineering as a Career" over our local State Education Station WNED-TV. The program, sponsored by the Erie County Chapter of the New York State Society of Professional Engineers, in conjunction with local sections of founder societies of engineering, is designed to interest high school seniors in a career of engineering.

Glenn E. Sherman,
Chairman of Publicity
Kenmore, N. Y.

Editor's Note: There are still a few copies remaining.

TRENCH WIDTHS & PIPE LOADINGS

With reference to John B. Powers' article, "Structural Design of Clay Pipe Sewers," which appears in PUBLIC WORKS for January, 1960, it should be pointed out that Marston's trench formula is applicable only where the pipe diameter is large relative to the trench width. There is no problem where the suggested design trench width of 3/2 d + 12" is adhered to, but this is very frequently not the case. Trenches are usually wider.

When a trench is wide with respect to the pipe diameter, loading is similar to the load of fill on a culvert, and is related to the pipe

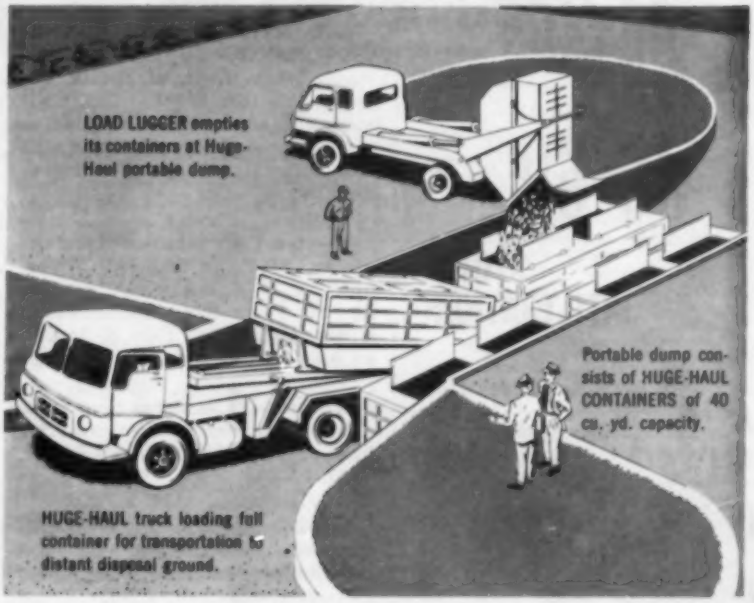
diameter, not the trench width, in accordance, usually, with Marston's formula for projecting conduits. The transition width, beyond which the load is constant regardless of trench width, is much narrower than is generally realized. For example, according to tables in Vitrified Clay Engineering Handbook, this width for 8″ pipe in a 10-ft. trench varies from 2′ 2″ to 2′ 7″ depending on the nature of the backfill material. Design according to the trench formula and the tables referred to by the author could be extremely conservative, as for example, an 8″ pipe in a 9-ft. trench; and it would be needlessly conservative for 8″ pipe in a 3-ft. trench. In this instance, for sand-gravel backfill 10 ft. deep, the trench formula would indicate a load of 2160#/ft., whereas the maximum possible load occurs at 2′ 7″ trench width and is 1750#/ft.

A much more serious situation, however, is the likelihood of an overload of large magnitude occurring when the design trench width is made too optimistically narrow, and then construction procedures are permitted according to usual practices. For example, an 8″ extra strength pipe with Type 2 embedment and a safety factor of 1.5 will support 15 ft. of sand-gravel fill in a 30″ trench, but only 10 ft. if the trench is made 33″ wide. Designers should be cautioned never to call for trench widths narrower than prospective contractors can conveniently dig them, and inspectors should be cautioned never to permit even apparently insignificant increases in trench width over design without checking for overload.

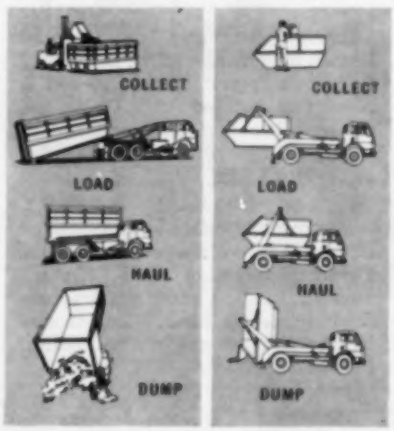
The Concrete Products Association of Washington recommends a design trench width of 1 1/2 d + 18″ with a minimum of 30″, and has prepared tables which show permissible depth of trench for the various classifications and sizes of concrete pipe, for three types of backfill and four types of bedding. These tables take into account the somewhat more favorable load factors which apply when the projecting conduit formula is used, and indicate the rather frequent instances when the design trench width is greater than the transition width. In all such cases there is nothing to be gained in holding the contractor to the design width, and knowledge of this can save both the contractor and the inspector much trouble.

Leland L. Sphar
Engineer-Manager
Concrete Products Assoc. of Washington
Seattle 99, Wash.

Cut your refuse hauling costs to pennies per yard...


LOAD LUGGER empties its containers at Huge-Haul portable dump.
Portable dump consists of HUGE-HAUL CONTAINERS of 40 cu. yd. capacity.
HUGE-HAUL truck loading full container for transportation to distant disposal ground.

...team HUGE-HAUL PORTABLE DUMP SYSTEM with your LOAD LUGGER refuse collection system



HUGE-HAUL SYSTEM
Containers from 10 to 40 cubic yards capacity.

LOAD LUGGER SYSTEM
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NEWS OF ENGINEERS

L. D. MATTER, formerly chief engineer, Water Supply Section, Pennsylvania Dept. of Health, has joined Albright & Friel, Inc., Consulting Engineers of Philadelphia, as a member of their engineering staff and their Harrisburg, Pa., representative.

WILLIAM T. INGRAM, consulting engineer, 20 Point Crescent, Whitestone 57, N. Y., has opened an office at 90 Panoramic Way, Walnut Creek, Calif., with FRED R. INGRAM as associate in charge.

WILLIAM J. CHASE has been made a junior partner in the consulting firm of Hill and Ingman, Seattle, Wash.

JAMES A. QUINLAN has been promoted to an Associate with Fred S. Dubin Associates, Consulting Engineers, Hartford, Conn.

ROBERT J. KUHN, New Orleans Consulting Engineer, has been awarded the Louisiana Engineering Society Technological Accomplishment Medal.

HOLWAY ENGINEERS, Inc., has been formed by a merger of W. R. Holway & Associates and Cornett, Wood & Associates, both of Tulsa, Okla.; and the new firm has been retained to report on the overall water needs of Henryetta, Okla.

MEYER STOLLER has been appointed Acting City Manager of Miami, Florida, succeeding IRA F. WILLARD who resigned to enter the business field. Presently Mr. Stoller is also budget director and internal auditor for the city.

FREDERICK R. KNOOP, Jr., has rejoined the consulting engineering firm of Whitman, Requardt & Associates, Baltimore, Md., after six years with Charles R. Scrivener Co., general contractors of Baltimore.

THOMAS R. LEACHMAN and JOHN R. BOOTON have become partners in the firm of Wiley & Wilson, Consulting Engineers, Richmond and Lynchburg, Va.

JOHN P. RILEY is now Vice-President for Development of Lockwood, Kessler & Bartlett, Inc., consulting engineers of Syosset, N. Y.

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GEORGE M. PARKER, JR., and C. L. SHIMEK have been elected vice-presidents of FORREST & COTTON, Inc., consulting engineers of Dallas, Texas.

Dr. ALFRED C. INGERSOLL has been named dean of the School of Engineering, University of Southern California.

● ● ●

California Sewage and Industrial Wastes

The California Sewage and Industrial Wastes Association will hold its 32nd Annual conference at the Claremont Hotel in Berkeley, California, April 27 to 30. Preconvention training sessions, one on plant operation, the other on sewer maintenance, will be held on April 27. Further information from A. D. Leipzig, Hyperion Sewage Treatment Plant, 12000 Vista Del Mar, Venice, California.

Traffic Engineering Short Course

A conference on "Traffic Engineering for the Growing City" will be held at the Georgia Institute of Technology, Atlanta, Ga., May 18-20. Full information is available from Richard Wiegand, Director, Short Courses and Conferences, at the Institute.

Training for Sanitary Engineer Officers

A program of advanced training for sanitary engineer officers of the Army, Navy, Air Force and Public Health Service will be held at the R. A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati, O., June 6 to 18. For detail information, write H. P. Kramer, Chief, Training Programs.

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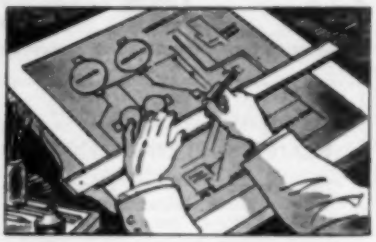

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Safety in Refuse Collection

(*Continued from page 92*)

sions will be, how often they will be held, what the subject matter will be, etc. There is no advantage to be gained in surprising them.

A little newspaper publicity can help too. The men will appreciate the attention they and the department receive, and the public will sense a well-run department that is trying to operate intelligently and economically.

9. *Hold the meetings.* Adequate preparation, including all 8 steps previously cited, should assure the success of training classes. If preparation has not been adequate it will be difficult to salvage anything of value in the training sessions.

10. *Follow* up the "skull" sessions with on-the-job supervision. With supervisors already trained in safety matters it should be relatively easy to arrange for follow-up supervision. Brief reminders delivered to supervisors at weekly or other regular meetings will aid in keeping them alert to safety problems and practices of their crewmen. Occasional pointers on what to look for will also help the supervisor to follow up the classroom work to advantage.

11. *Plan and operate a program "in depth."* A one-shot program consisting of a series of 6 classes or 10 classes loses much of the potential value of safety training. After the initial series is over a continuing but less concentrated program should be maintained through "roll-call" or "tail-gate" training sessions. These are simply short (perhaps 10-minute) get-togethers held before the men go out on their runs. One or two sessions a week should be enough to keep safety a constant concern.

12. *Keep records.* Records should be set up and maintained before and after the training program. By setting up the record system in advance, some conclusions can be drawn about the tangible value of a training program. Regardless of the timing, however, a systematic records program should be created and continual analyses made to determine practices which need changing and the effects of various types of safety measures. In this way the safety practices can constantly be improved. By publicizing the improvements in the safety record and the way in which they were brought about, the public is given further reason to appreciate and respect the work of the department.

13. *Suggest feature news* articles

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on the safety program. Publicizing the changes in the safety record is one obvious subject, but there are countless human-interest possibilities and other types of stories in the operations of any department. Was an accident clinic set up? Tell the news reporters. Does one of the employees have an exceptional safe-driving record? Does another have all of his toes today in spite of the heavy can dropped on his foot—thanks to safety shoes? Tell the reporters and give them some family background on the men. Stories of this nature are not news, but they are widely-read features—especially in the newspapers of medium-sized and smaller communities. Here again, such articles boost employee morale and demonstrate to the public one aspect of efficiency of the department.

14. As a last step in the training cycle, make adjustments in instruction, directives, the preventive maintenance program and other facets of the safety efforts on the basis of analysis of records and on-the-spot observations of safety practices.

Any brief article somewhat oversimplifies problems and solutions. The essential problems of safety in refuse collection are rather common, however, and can easily be discovered in any city through relatively simple records. With the program for training outlined plus a leaven of ingenuity, some respectable inroads can probably be made on accidents in any departments of refuse collection.

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2. Correspondence with Clarendon Rea, Commissioner of Refuse Collection, Kansas City, Mo.
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4. Bureau of Labor Statistics.
5. Correspondence with Leon R. Burton, Sup't of Sanitation, Dep't. of Public Works, San Diego, Calif.
6. Kent W. Francis, "Accident Prevention for Municipal Employees." *Public Management*, Aug., 1943, P. 228-232.
7. Sherwood Reeder, *Public Management*, March, 1952, page 61.
8. Orin K. Cope and George A. Fish, "How to Reduce Employee Accidents." *Public Management*, Jan., 1953, pages 7-9.

Water Use and Sewage Flow

In Ithaca, N. Y., in 1959, 34,000 people served with water used an average of 105.6 gallons per person per day. The sewage flow from 32,000 population averaged 126.7 gallons per capita per day.

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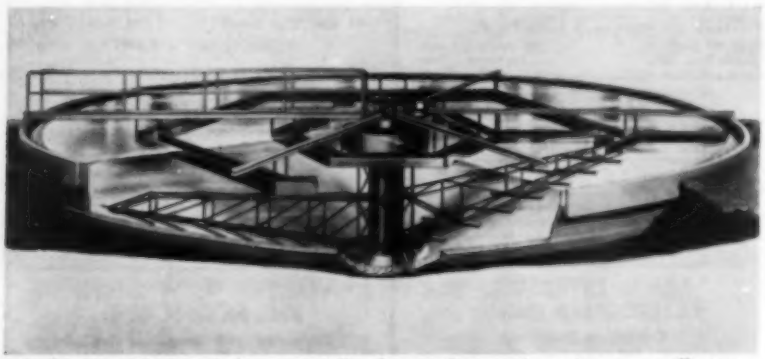


Series U settling tank has a rapidly sloping floor and a rake type collector.

Sludge Collectors

Two new types of Circuline sludge collectors for water, sewage and industrial waste treatment plants have been announced by Link-Belt Company and are included in a new 28-page Book 2546. The two new types include: Series U, a new Uniflow settling tank with rapidly sloping bottom, rake-type sludge collector and multiple effluent weirs; Series A, a new aeration sludge collector for pre-aeration and settling. Series A sludge collectors consist of a single circular tank in which both aeration and settling are accomplished. The collecting mechanism removes the solids from both the aeration compartment and the settling compartment. These collectors are built in two types—Type AP for preliminary aeration of 30 to 60 minutes and Type AT for total aeration with extended aeration of 24 hours.

Link-Belt Co., Prudential Plaza, Chicago 1, Ill.

Circle **No. 4-1** on the convenient reply card facing page 34.

Spreader

This new tailgate spreader has been designed for spreading sand, salt, cinders, gravel, slag, or other material, seal-coating highways and soil stabilization of secondary roads. Features of the "Rollgate" include all welded steel construction, 8-feet wide spread, ability to spread as little as 75 pounds of chemicals per mile to any desired amount, and applications from a feather edge to a three-inch depth when seal-coating. Material in the dump truck can be emptied over the spreader without unhooking it from the truck. Fitting any seven-foot, six-inch or eight-foot wide dump truck body, the spreader is cab operated and hydraulically driven either by connecting into an existing truck hydraulic system or by a separate P.T.O. pump and package.

Spreader provides metered distribution.

Good Roads Machinery Corporation, Minerva, Ohio.

Circle **No. 4-2** on the convenient reply card facing page 34.

Tractor Shovel

A new 11,000-lb. capacity rubber tired tractor shovel has been introduced by Pettibone Mulliken. Designated the Model PM-440, it has a lifting capacity of 21,000 lbs., and a breakout force of 24,800 lbs. Depending upon the weight of the material being handled, buckets are furnished in SAE heaped capacities of 3.00; 3.25; 3.90 and 4.25 cu. yds. Bucket rollback at ground level is 40°. Standard equipment includes power shift transmission; torque converter; 4-wheel hydraulic power assist brakes; dual hydraulic cylinder assisted steering; 4-wheel drive; and automatic bucket leveler.

Pettibone Mulliken Corp., 4700 West Division St., Chicago 51, Ill.

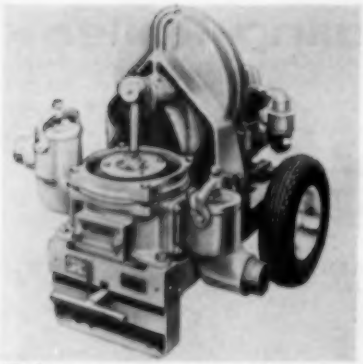
Circle **No. 4-3** on the convenient reply card facing page 34.

Chemical Feeder

A heavy-duty, positive displacement, chemical solution feed pump of the diaphragm type is available from Precision. The Model 801 will operate against pressures up to 60 psi with a capacity to 20 gpd. All solution handling parts are of chemically resistant materials; the pump head is transparent plastic. Common applications for this pump are for hypochlorites, caustic soda and soda ash, fluorides and hexametaphosphates.

Precision Chemical Pump Corp., 1396 Main St., Waltham 54, Mass.

Circle **No. 4-4** on the convenient reply card facing page 34.



Sludge pump uses neoprene ball valves with replaceable seats to extend life.

Diaphragm Pump

McGowan Pumps has announced a new ball valve diaphragm pump for pumping of sludge and heavy, lumpy liquids which normally clog other pumps. Easy to get at, specially weighted neoprene ball valves give a forceful, positive closing that insures greater pumping efficiency with difficult-to-pump viscous fluids. Ball valves have replaceable seats to extend efficient pump life. Capacities are 3,000 to 6,000 gph.; sizes are 3" or 4" with electric motor or engine drive; base mounted or wheel mounted on steel wheels or pneumatic tires.

McGowan Pumps, Division of the Leyman Mfg. Corp., 3400 Central Parkway, Cincinnati 25, Ohio.

Circle **No. 4-5** on the convenient reply card facing page 34.

Runway Light

Crouse-Hinds has a new medium intensity airport runway marker light (Model 2 Type ERL) with a spring mounted tilting cone. A sheet steel spring allows the cone to tip slightly, instead of breaking off, under stress (as for example in a high wind, or when struck by wet snow during snow removal). This makes it particularly useful with jet aircraft operations, since the strong exhaust blast presents a hazard to inflexible lights. Model 2 ERL fixture with clear or green globe is normally used on non-instrument runways; with blue symmetric globe it is used for standard taxi light locations, such as intersections, corners, and short taxiways; an asymmetric blue globe, which provides two main beams, is available for long straight taxi strips.

Crouse-Hinds Company, Syracuse 1, N. Y.

Circle **No. 4-6** on the convenient reply card facing page 34.

Vertical Magnetic Drive

Electric Machinery has developed a new line of vertical magnetic drives designed particularly for pump drive applications. Manufactured in five sizes, the vertical "Ampli-Speed" can provide variable pumping speeds over a range from 0-1740 rpm. With variable speed pumping through the drive, pump speeds can be exactly matched to flow demands. A variety of sensing controls can be used to make pump operation completely automatic. Also, the units have a built-in speed control circuit which hold a pre-set drive speed to within ±2%. The unit is air cooled. Technically, it is called an eddy current slip device, utilizing two rotating members which "slip" with respect to one another. The drive control is all transistorized and is mounted in its own small cubicle.

Electric Machinery Mfg. Co., Minneapolis 13, Minn.

Circle **No. 4-7** on the convenient reply card facing page 34.

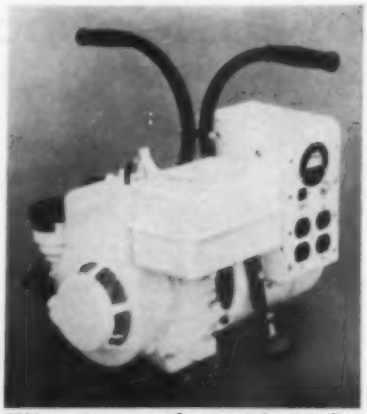
Heated Roller

This heated roller, which uses LP gas, permits sealing and compacting patches, driveways, etc., with a light weight unit. It works with hot or cold mix, eliminates hand tamping and smoothing and produces a water resistant seal. Operating for 9 hours on a 20-lb. bottle, it works flush to curbs and in other difficult-to-reach places. Transportation is by attachment to truck tailgate. Width is 18 ins.; heat-up time is 10 minutes; weight wihout LP6 bottle is 148 lbs.

Aeroil Products Co., Inc., South Hackensack, N. J.

Circle **No. 4-8** on the convenient reply card facing page 34.

Roller is equipped with LP gas supply.



2500-watt power plant weighs 110 lbs.

Electric Plant

Pacific Mercury has re-designed its 1750, 2000 and 2500 watt electric plants, reducing the weight of these generators by 25 pounds and increasing horsepower from 10 to 15%. The largest of these portable electric plants, the 2500 watt model, weighs only 110 pounds. All three of these PM electric plants have, as standard equipment, six receptacles for multiple operation of power tools and other equipment, electric start, hi-lo battery charge on all AC models, RPM indicator and cast aluminum skids. Shock-absorbing skids are available if desired.

Pacific Mercury, 13232 Leadwell, North Hollywood, Calif.

Circle **No. 4-9** on the convenient reply card facing page 34.

Colored Asphalt

A new light colored asphalt sealer gives asphalt drives the appearance of a painted surface and at the same time adds years of life to the asphalt. It comes in a number of colors—grey, red, green, buff and brown. Color-Cosmicoat is a rubberized plastic emulsion that has all the sealing properties of the black coal tar pitch emulsion sealers used extensively to protect asphalt surfaces. But, being light in color, it reflects light instead of absorbing it. Lighting bills are considerably reduced as lower watt bulbs can be used to produce the same amount of light for outdoor areas. Color-Cosmicoat is easily applied by brush or squeegee, bonds to new and old asphalt surfaces and seals in the asphaltic oils, withstands heavy traffic and abrasion without flaking or breaking, and does not bleed.

D. C. Harris Company, Wooster, Ohio.

Circle **No. 4-10** on the convenient reply card facing page 34.

Faster Loader

Power steering and no-clutch transmission speed up loading.

Speedup of crawler tractor load moving cycles is claimed by The Oliver Corporation in the company's new OC-96 tractor-loader. Powered by a 4-cylinder, valve-in-head diesel engine, the OC-96 delivers 62 gross engine horsepower, and features power steering and Trans-O-Matic transmission. A torque converter is provided as standard equipment. Other features include: a 96-in. dumping height and 45-degree dump angle; 33-in. dumping reach; 9,200-lb. breakout force; 1-cubic-yard bucket that is self equalizing from ground to maximum lifting height; lower roller track guards and hydraulic filter furnished as standard equipment; rubber bumper guards with recessed radiator and lights to protect against front-end damage.

The Oliver Corporation, 400 W. Madison St., Chicago 6, Ill.

Circle **No. 4-11** on the convenient reply card facing page 34.

Vibrating Roller

Separate clutch permits use as vibratory or static roller.

The new Littleford Model 125-V "Vibra-Topper" vibratory powered roller has the vibratory portion controlled by a separate clutch so the unit may be used as a 1-Ton static Roller for Black Top or an 8-Ton vibratory roller for Base Rolling. It produces 2600 lbs. of thrust for maximum compaction and incorporates engineering features which permit ease of operation, transporation and maneuverability.

Littleford Bros., Inc., 457 East Pearl Street, Cincinnati 2, Ohio.

Circle **No. 4-13** on the convenient reply card facing page 34.

Plastic Globe

A new luminaire with a virtually unbreakable plastic refractor is now available from General Electric for use in rural or suburban lighting. This Acrylic-Suburban unit is constructed with a built-in ballast for up to 250-watt mercury vapor lamps or without ballast for up to 6000-lumen filament lamps. Unaffected by corrosive atmosphere, resists thermal shock and is interchangeable with glass refractors of similar design. BB pellets and rocks will bounce off; .22 bullets will penetrate but not shatter the refractor. Different refractor designs give Illuminating Engineering Society Type II, Type II 4-way, and Type V light distribution patterns. All units have a locking type receptacle so they can be used with the new General Electric cadmium-sulphide photoelectric control for automatic dusk-to-dawn lighting. The Acrylic-Suburban luminaire is designed for suburban streets and homes, service stations, motels, roadside shopping areas, rural homes and driveways, barnyards and work areas, plants and parking lots, school and church yards, and other area lighting applications.

Unbreakable refractor for the suburbs.

General Electric, Schenectady 5, N. Y.

Circle **No. 4-12** on he convenient reply card facing page 34.

Radio Controlled Traffic Signal

A mobile radio-controlled traffic signal designed particularly for truck crossings and road construction sites has been announced for applications where two-way traffic must be restricted to one lane and must feed in alternate directions, such as at one-way bridges, tunnels, truck entrances, and numerous other hazardous traffic locations. Two of these signals, 800 feet apart, and remotely controlled by radio, will provide safe, reliable, and easily recognized traffic signalization at a considerable saving in cost over flagmen or expensive temporary power lines. The one-way lane directional signal consists of a standard single face, two or three-section head equipped with ITE-approved 8⅛" and 12" lenses, and mounted on a portable base containing battery and control unit.

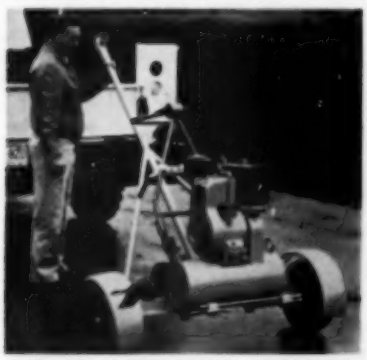
The entire unit is easily moved about on wheels or can be rapidly disassembled for transportation. Control is accomplished either by push-button cable, or by means of a hand-sized radio transmitter operating on the 27.2 mc Citizens Band.

Porta-Signal Division of Dryomatic Corporation, Alexandria, Va.

Circle **No. 4-14** on the convenient reply card facing page 34.

Tamper Trailer

This specially-designed trailer makes Jay Tampers easily transportable. The Trailer is scientifically balanced to permit easy loading and unloading by one man, whether he is moving the 235-pound Model J-13, the 335-pound J-18, or the 440-pound J-36. The trailer carries any one of the three. Previously, the machines could be moved from job to job only by (1) lifting them onto



trailers or trucks or (2) letting them propel themselves at the rate of 50 to 100 feet per minute, compacting as they went. The new trailer weighs 110 pounds and is of tubular welded construction. It has two disc wheels with pneumatic tires.

J. Leukart Machine Co., Inc., Columbus, O.

Circle **No. 4-15** on the convenient reply card facing page 34.

Litter Bag

This litter bag has a bright orange polyethylene liner. Thus the bag with liner can be used to pick up trash or litter; the liner, when filled, is dropped in a convenient spot for later pick-up, and its color makes it easy to find. The bag can also be used around refreshment stands or in picnic areas. The liner is strong enough to use again and cheap enough to discard.

Seely Associates, Eatontown, New Jersey.

Circle **No. 4-16** on the convenient reply card facing page 34.

Hot Roller

The "Hot Witch" uses the principle of heat in applying patches in asphalt paving, both cold and hot mix. It provides a method for smoothing patch spots, sealing the surface, and bonding the patch to the surrounding areas. It consists of a heavy roller inside which is a propane-fired heater capable of heating the roller to a temperature of 800 degrees in four minutes time. The device is propelled by hand. It provides asphalt compaction equivalent to five tons of dead weight.

The Charles Machine Works, Inc., 1959 West Fir Ave., Perry, Okla.

Circle **No. 4-17** on the convenient reply card facing page 34.

Trencher

A new crawler-type trencher and backfill machine—the Davis T-66 features positive traction, hydraulic variable speed drive, instant forward and reverse, and virtually effortless control of the complete trenching and backfilling operation. It digs 3″ to 4″ wide down to 66″ deep; or 12″ wide, 30″ deep; and at varying widths and depths in between. Creeping speed is controlled accurately by a hydraulic valve setting. Trenching speed is from 1′ to 12′ per

Trencher and backfiller in one unit.

minute. All digging widths—3 to 12 ins.—are obtained from only two tooth combinations. This gives flexibility in operation with a minimum tooth inventory, and it also reduces replacement costs. The boom telescopes and is adjustable to 42″, 54″, and 66″ maximum depths. The Davis T-66 is designed to do its own backfilling. A special backfill blade attaches to the boom and is raised or lowered hydraulically.

Davis Mfg. Co., Inc., 1500 So. McLean Blvd., Wichita 13, Kans.

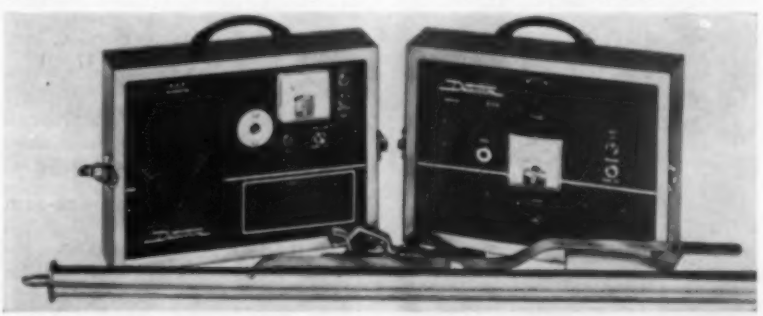
Circle **No. 4-18** on the convenient reply card facing page 34.

Pipe and Valve Finder

A new transistor pipe detector, the Detectron Model 808, is not merely an adaptation of tube circuits. Inadequacies, such as heat limitations, have been eliminated by the use of special compensating circuitry. Thus, the 808 is suitable for use in hot southern climates. The detector uses standard batteries which require replacement on the average about once a year. The 808 is designed not only to detect and trace pipes, cables, conduits, etc., but to locate valve boxes, services, studs and miscellaneous metallic objects. The depth of a pipe or cable can usually be quickly estimated by triangulation. Also, if necessary, a pipeline can be located so precisely that it can be marked on the pavement above within an area narrower than the width of the pipe itself. Depth range on one-inch water pipes approximates 10 feet, and maximum depth range on large lines is 20 to 25 feet.

Computer Measurements Co., Division 6, Sylmar, Calif.

Circle **No. 4-19** on the convenient reply card facing page 34.



Transistorized detector uses a conductive method of tracing pipes and cables.

Compactor

Two improved models of self-propelled pneumatic-tired rollers, SP-91, 10 ton, and SP-111, 12 ton are announced by Tampo. Both have increased maximum recommended load capacity. Torque converter drive and automatic power shift reverse operation, with 6 speeds forward and reverse, are standard equipment on both models. Recommended loads are 20,000 pounds for the nine-wheel, and 24,000 pounds for the eleven-wheel machines. Hydraulic wheel brakes are installed on all driving wheels, plus separate differential brakes at the transmission. The differential brakes yield improved operation on wet or slippery fill materials. The hydraulic service brakes are equally effective in both forward and reverse directions, and brake drums are sealed.

Tampo Mfg. Co., Inc., P. O. Box 4248, Station A, San Antonio 7, Texas.

Circle **No. 4-20** on the convenient reply card facing page 34.

Highway Mower

The Topeka Forty-Mile Mower is now available with 36 x 20 low pressure Terra Tires. Each tire has 210 square inches of contact area as compared to 18 ins. with regular tires. When used on the four-wheel drive Topeka Mower, the greater flotation area permits the mowing of steep slopes impossible to mow by conventional means and also permits mowing in wet ditch bottoms and in marsh areas now being mowed by hand. The low pressure tires, which are quickly interchangeable with regular high pressure tires, can be used on any model Topeka Mower, such as the front mounted Hammermill, side mounted Rotary or straight Sicklebar mowers. All other Topeka attachments can be used in conjunction with the low pressure tires.

Four-wheel drive mower takes to slopes.

Topeka Hiway Mower Co., Inc., 623 E. 7th St., (Box 720), Topeka, Kans.

Circle **No. 4-21** on the convenient reply card facing page 34.

Former-Decker

Trofdek, a new structural building component capable of 50-foot clear spans, is a unique application of the folded plate idea in which thin sheets of plywood are glued to light lumber stiffeners in a series of miniature troughs, producing a roof or floor component with extremely light weight. It has been used for roof structures, floors and concrete forms in more than 500 buildings in Great Britain and Canada. The troughs, joined on a 16-inch module, run parallel to the span and vary in depth from 5¾ to 15½ inches. The component is capable of carrying up to 100 times its own weight. Two men can easily handle a standard 100-sq. ft. panel, although the material combines both framing and deck. Trofdek may be used as either removable concrete forming or as a permanent part of the pour. In either case, reinforcing steel may be laid directly in the troughs. Where the component is used alone or left in place after serving as formwork, a wooden ceiling with an unusual, pleasing texture is the result.

Plywood Fabricators Service, Inc., 3500 E. 118th St., Chicago 17, Ill.

Circle **No. 4-22** on the convenient reply card facing page 34.

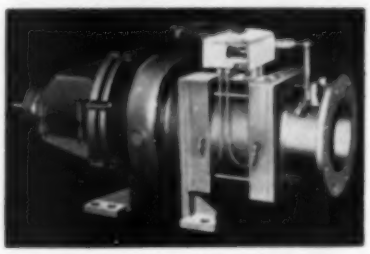
One-Man Digger

Arps announces a new, one-man operated trencher, the Model MA-2 Trench Devil. It is designed for contractors, utilities and municipalities for such jobs as gas lines, water services, foundations, street lighting, electrical and telephone cable, signal and sprinkler systems. Weighing approximately 1080 lbs., the unit can be easily skid-loaded on pickup trucks or small trailers, or it will travel under its own power at 3 miles per hour. There are five digging widths—2¾ to 8 ins. and to 54" deep. Digging speed is to 1200 feet per hour in either direction. At 2-ft. depth, digging speed averages 205 ft. per hour with an 8" width; a 4 ft. depth produces 105 ft. per hour at a 4" width. When digging depth is reached, a pointer is set in line with a marker. Successive raising and lowering of the boom always brings unit back to the desired depth without any additional measuring. One-side dirt delivery can be changed to either side within 60 seconds. Optional rear dual wheels provide extra traction and flotation in muddy soils.

The Arps Corp., New Holstein, Wisc.

Circle **No. 4-23** on the convenient reply card facing page 34.

Pump Control System

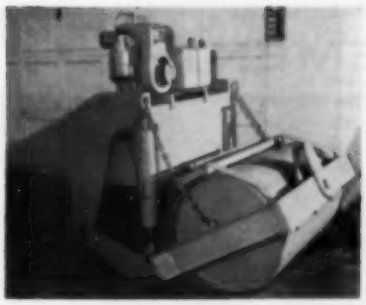


Pneumatic controller for ACAP pumps.

An improved pneumatic control system has been announced by Allis-Chalmers for its adjustable-capacity, adjustable-pressure (ACAP) pumps. This system automatically adjusts the cylinder of the single-stage, single-suction pumps by air pressure. The design eliminates all gearing by building into the ACAP body the operating air cylinder. The entire ACAP assembly then becomes a tubular shaft air cylinder, the flow to the pump impeller passing through this moveable hollow shaft. Increasing the air feed to one side of the piston moves the cylinder in or out to regulate recirculation and flow at the discharge nozzle. The ACAP pump is available in sizes up to 10-inch discharge and larger sizes will be considered.

Allis-Chalmers Mfg. Co., Industries Group, Milwaukee 1, Wisc.

Circle **No. 4-24** on the convenient reply card facing page 34.



Rear Roller

A new version of its GraderrolleR, the Model GR-42HG, featuring an independent, gasoline engine driven hydraulic pump, is announced by the Martin Company, Kewanee, Illinois. A general use road surfacing roller attached to the rear of motor graders, the Martin GraderrolleR handles compacting-rolling duties and is available at any time the motor grader is available. The unit mounts a Wisconsin Model BKN single-cylinder, air-cooled gasoline engine on the top roller frame and uses the weight of the grader to exert up to 225 lbs. of compaction per linear inch of its 42-in. wide roller. The roller is pivoted at the center and follows the road surface regardless of the grader's position during operations. Remote controls allow full operating adjustments to be made from the grader operator's platform. Spring tension scraper blades and a 35-gal. automatic sprinkling system keep the roller free from sticking asphalt during operations. Whenever the roller is lowered into operating position the sprinkling system starts.

Martin Co., 620 Andrews Ave., Kewanee, Ill.

Circle **No. 4-25** on the convenient reply card facing page 34.

Rotary Cutter

This rotary cutter, the Mow-All 96, mows a clean 8-foot swath. It is different in that the blades travel in opposite rotation thereby eliminating the over-throw of cut material into the area of uncut material. The blades are driven through 30 horsepower gear boxes. The mower is available in both lift and trail types; on the trail type the wheels can be either rear or side mounted. This unit is especially adaptable to wide rights-of-way where the area covered is a factor. A 25 horsepower tractor is required for operation.

B M B Co., Inc., Holton, Kans.

Circle **No. 4-26** on the convenient reply card facing page 34.

Five Speed Crawler Tractor

A new 59-hp crawler tractor has been announced by Minneapolis-Moline. Diesel and gasoline engine models have been integrated with a 5-speed transmission. There are five forward speeds from 1.3 to 7.25 mph, with a 25% increase in five reverse speeds up to 9.07 mph. The engine is 4-cylinder and delivers 59 hp at 2000 rpm on gasoline, and 53 hp at 2000 rpm on diesel. Most important advance is the Minneapolis-Moline "heel-and-toe" forward-reverse directional control. This frees the operator's hands for full attention to operating attached tools and steering. Design provides for easy mounting of attached equipment. The loader is mounted on the cross shafts and secured at 4 points. The dozer has a simple 4-point mounting on the track frame. The scarifier is easily mounted on two arms bolted to the differential housing. Other attached equipment, such as backhoes, side-booms, winches, etc., can also be easily mounted.

Minneapolis-Moline Co., Hopkins, Minn.

Circle **No. 4-27** on the convenient reply card facing page 34.

Three-Piece Grader Blade

Extensive grader blade field tests according to Paper, Calmenson & Co., show that a new three-piece blade installation can save the grader owner as much as 70% in grader blade costs. This three-piece installation consists of a hardened thicker blade in the center and two conventional blades on the ends. Two factors, the crown of a roadbed and the concentrated weight of the machine cause accelerated wear on the center of the blade. In practice, many sets of grader blades are thrown away before they are completely used because they are crowned too much for good road work. The three-piece grader blade arrangement with heavier hardened blade in the center prevents this excessive crown. Pacal heat treated bolts were used in the field tests. Because of increased wear and added life of these heavier blades, regular plow bolts could not be expected to stand up through the entire life of the blades.

Grader Blade Department, Paper, Calmenson & Co., St. Paul 13, Minn.

Circle **No. 4-28** on the convenient reply card facing page 34.

STREET and PARK

Type 48-F

Refuse Receptacles

Tarco "Paragon" receptacles have gobbled litter and trash **since 1883.** **Rugged** construction: welded, heavy gauge steel. Large capacity. Locking removable hoods. **Two big doors,** vertically hung, open and close without springs. **Safe to use** . . . no scraped fingers. Stainless steel feet. Baked enamel finish. Decals. Innerliners.

TARRANT MFG. CO.
28 JUMEL ST.
SARATOGA SPRINGS, N. Y.

World's Finest Official Board
Rugged Aircraft Girder Construction, Unequaled in Design, Durability and Performance by any board built today.
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ANDERSON, INDIANA, U. S. A.
WORLD'S LARGEST MANUFACTURERS OF FINE PARK, PICNIC, PLAYGROUND, SWIMMING POOL AND DRESSING ROOM EQUIPMENT

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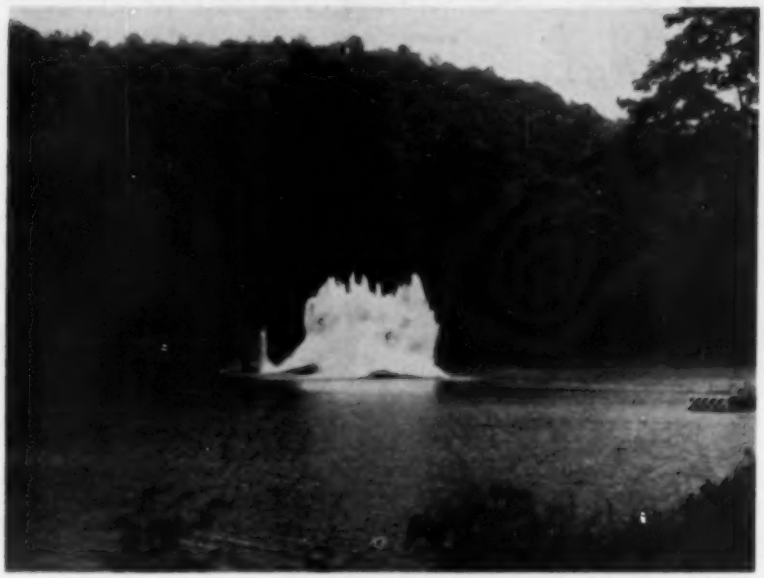
Contractor Produces Movie on Demolition



● FOR removal of a dam, the crest was submerged before the explosive was fired.

WILLIAM F. HALLSTEAD

ONE of the country's most imaginative demolition contractors, Burnbrae, Inc., (see "Dynamite + Imagination & Experience = Economy", PUBLIC WORKS, July, 1959) has completed an unusual 14-minute color movie. It features some remarkable building demolition sequences: the total razing of several 8-story apartments in Washington, D.C., in less than a quarter minute each. Jack Loizeaux, president of Burnbrae, is reportedly the only dynamite specialist in the U.S. known to knock down major buildings with a single firing.

The film is not confined to building demolition, but portrays other applications of explosives as well. An underwater clearance project is shown, and several startling sequences demonstrate the accuracy of chimney felling with dynamite. Another interesting Burnbrae project shown is the use of fractional stick charges to remove portions of a bridge directly above the B & O Railroad in Washington, D.C. Here dynamite is used because the vibration of a headache ball would have damaged utility conduits in the bridge. This sequence is followed by a seaplane basin clearance project in which heavy charges are simply dropped from a barge and fired to break up an underwater limestone layer. The climax of the film is the demolition of a lock wall on the Monongahela River with 7300 pounds of Nitramon in a single blast. This and one of the building razings are repeated in stop-motion sequences that permit close observation of the progress of timed charges.

The film was edited by Monumental Films, Baltimore. Narration is by Galen Fromme, noted Baltimore TV and radio newscaster. For more information on the film entitled "Demolition With Controlled Explosives", contractors' groups and city officials can contact Burnbrae, Inc., 110 E. Chesapeake, Baltimore 4, Maryland.

Cost of Producing Water

The cost of production of one million gallons of water is reported by the Minneapolis, Minn., Water Department for 1958 as follows: Administration $7.04; commercial $12.13; distribution $26.68; meter repairs $6.16; plant maintenance $6.12; pumping $29.49; filtration $24.44; softening $34.53; a total of $146.59. In addition were the following, on the same basis: Major repairs $11.51; water main cleaning and lining $9.78; debt service $28.72; pension costs $4.56; and depreciation $28.94. This makes a total cost of $230.10 per million gallons.

• • •

"No Splash" Street Flushers

THIRTY new International no-splash flushing trucks were recently placed in service by New York City's Department of Sanitation. The new trucks are equipped with 15 nozzles that spray water almost vertically onto the street. Older model spray trucks dispersed water almost horizontally, often to the chagrin of pedestrians in the immediate area. The International model CO-212 chassis is equipped with a 2,500 gallon tank and pumping apparatus that delivers water at pressures ranging from 24-25 pounds. The trucks can be equipped with blades for snow removal. The City of New York Department of Sanitation operates approximately 1,600 trucks, of which 1,400 are International.

● COMMISSIONER Paul Screvane of the New York City Department of Sanitation makes a close up inspection of one of the new "no splash" street flushing trucks.

by Arthur K. Akers

★ Caterpillar Tractor Co. announces major reorganization changes to promote engine sales. These include promotion of **Jack H. Gill,** former engine sales manager, to a staff position with a wide variety of Engine Division functions to assist **H. H. Howard,** vice president. **Fred V. Jacobs** succeeds Gill as engine sales manager. Serving under him will be **Bob Cumming** as manager of Manufacturers Sales Division; **Hugh Rose,** manager of

Mr. Gill

Mr. Jacobs

Dealer Sales Division; and **Gene Sterrett** heading up Sales Development work.

The announced object of these major moves is to provide more aid to Caterpillar dealers in their engine sales efforts as well as to the original equipment manufacturers. The Engine Division also plans to increase sales aggressively through new exclusive engine dealerships, such as the appointment of Ingersoll Corporation of Shreveport, La. Other features will be the use of more compact high output units, more intensive dealer sales training programs under **Ken Grimes,** and a well rounded advertising and promotion effort. The new engine plant near Mossville, Ill., provides the opportunity for expansions in manufacturing area and personnel.

★ **William J. Grede,** formerly president of Grede Foundries and a president of the National Association of Manufacturers, succeeds **Marc B. Rojtman** as president of **J. I. Case Co.,** Racine, Wis. The latter remains as special adviser in Case expansion programs.

★ With Hawaii our 50th state, first news from there to appear here is that **Matt Cabot** represents **Pfaff & Kendall** in Honolulu for sales of lighting standards.

★ C.I.M.A. news includes election of **Donald V. Buttenheim,** president of **Buttenheim Publishing Corp.,** as president; and **W. D. Lease** of **Athey Products Corp.,** Chicago, as a director.

★ **The Foxboro Company** has opened two new direct branches, in Portland, Oregon and Seattle, Wash. **F. J. Renner and I. D. Hummel,** respectively, manage them.

★ **Smith & Loveless Division of Union Tank Car Co.** has begun construction on a quarter-million dollar manufacturing plant expansion at Lanexa, Kans., its fourth since early 1958.

★ **Gordon Smith & Co.,** Bowling Green, Ky., has moved into its new and much larger plant. With its 1959 air compressor sales 25% ahead of the previous best year, expansion had become mandatory.

★ District Sales representation for the **Flygt** line of submersible pumps is enlarged by addition of **Hessel H. Holland** for Southern sales and **Roger K. Warren** for the eastern Midwest.

★ **William W. Taylor** of Cincinnati, "the man whose 'Silent Knight' took the noise out of manhole covers," was recently given an Achievement Award by the **National Noise Abatement Council"** for this great service to urban humanity.

★ **David D. Ackerman,** formerly president of **Ludlow Valve Mfg. Co.** is the latest addition to **Hays Mfg. Co.** General Products Division. Ackerman will be responsible to their sales in the entire New York metropolitan area.

Mr. Ackerman

Mr. Hartley

★ **John R. Hartley** again moves up, to president of **Builders-Providence, Inc.,** division of B-I-F Industries, Providence, R. I.

★ **Harold M. Ferris,** widely known in the valve and hydrant industry, joins **A. P. Smith Mfg. Co.** sales staff, at East Orange, N. J.

★ **Holland S. Frink,** vice-president and sales manager, Frink Sno-Plows Inc., Clayton, N. Y., died March 5th, according to an announcement received as we go to press.

★ "Is your new secretary very intelligent?"

"I don't know. She just came to work this morning, and when I went to lunch she was still trying to get EStablished 1901 on the phone."

James B. Cook Jr., (right) general sales manager, General Products Division, Hays Mfg. Co., Erie, Pa., being sworn in as Assistant Director, Mobilization Planning, Water and Sewerage Industry and Utilities Division, U.S. Business and Defense Services. W. A. White, Sr., BDSA Administrator, left; Walter Picton, center.

HORTONSPHERES

help reduce operating costs at South Bend treatment plant

South Bend, Indiana's sewage treatment system uses digester gas as low-cost fuel to drive sewage pumps and air compressors.

To equalize the variable gas production with demand, CB&I furnished these two 45 ft. diameter Hortonspheres®. Excess gas is stored in them at 40 lbs. per square inch working pressure—and released according to demand.

Hortonspheres are in demand *wherever* progressive operators seek to reduce sewage plant operating costs, for two reasons: Hortonspheres store *more* in *less* space; and, their performance is backed by seven decades of CB&I's craftsmanship in the design, fabrication and erection of steel plate structures.

Write your nearest CB&I office for details on Hortonspheres—for either digester gas or municipal gas service.

M150-R

3 WAYS SEWAGE PLANTS SAVE with HORTONSPHERES

- Store more . . . in less space
- Smooth out pressure variations
- Provide peak load gas reserves

Continuing improvements by CB&I in design, testing, fabricating, and erection techniques and equipment — plus new tougher steels with higher yield strength, have considerably extended the volume of gas that can now be stored at high pressure.

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